Final

PUGET SOUND STEELHEAD EAST KITSAP DIP

Recovery Plan

Prepared for

The Suquamish Tribe

May 2020

Female steelhead on Kitsap Peninsula. Photo credit: Long Live the Kings

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Prepared by ESA in collaboration with the Suquamish Tribe

Susan O'Neil

Ilon Logan

Pete Lawson

Jimmy Kralj

5309 Shilshole Avenue, NW
Suite 200
Seattle, WA 98107
206.789.9658
www.esassoc.com

THE SUQUAMISH TRIBE

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TABLE OF CONTENTS

PUGET SOUND STEELHEAD EAST KITSAP DIP

Page

Appendices

List of Tables

List of Figures

Acronyms, Abbreviations, and Definitions

B-IBI	Benthic Index of Biotic Integrity
BMPs	best management practices
CAO	Critical Areas Ordinance
CARA	critical area aquifer recharge area
C-CAP	Coastal Change Analysis Program
DIP	Demographically Independent Population
DoD	Department of Defense
DPS	Distinct Population Segment
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
GIS	geographic information system
HUC	Hydrologic Unit Code
Lead Entity	Watershed-level salmon recovery organization, typically Chinook
LID	low impact development
LIO	Local Integrating Organization
LLTK	Long Live the Kings
MPG	major population groups
NGO	non-government organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NWIFC	Northwest Indian Fisheries Commission
PSP	Puget Sound Partnership
PSSRT	Puget Sound Steelhead Recovery Team
PUD	Public Utility District
Recovery Team	Puget Sound Steelhead Recovery Team
REPI	Readiness and Environmental Protection Integration
SAR	Smolt to Adult Return Rate
SRFB	Salmon Recovery Funding Board
TAG	Technical Advisory Group
TRT	Technical Recovery Team
UGA	urban growth area
VSP	Viable Salmonid Population
WBD	Watershed Boundary Dataset
WDFW	Washington Department of Fish and Wildlife
WREC	Watershed Restoration and Enhancement Committee
WRIA	Water Resource Inventory Area
WSPER	West Sound Partners for Ecosystem Recovery

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1 INTRODUCTION AND BACKGROUND

1.1 Purpose of the Plan

The purpose of a recovery plan is to communicate the current understanding of the species biology and the ecological requirements for the species to be viable within the geographic area of focus, as well as the strategies necessary to improve ecological function in order to increase viability in the time horizon of the plan. Viability of the East Kitsap steelhead (*Oncorhynchus mykiss*) population, which would support the delisting of Puget Sound steelhead is a desired outcome from successful implementation of this recovery plan. Delisting is the determination that the Puget Sound steelhead are no longer under threat of extinction and can be removed from the Endangered Species list. However, a fully recovered and harvestable population is the ultimate outcome for successfully implementing recovery.

This plan describes the current understanding of steelhead in the East Kitsap geography, including the habitats that steelhead rely on as the current and predicted future causes of degradation to those habitats. The plan includes a set of strategies to protect and restore the most important habitats to expedite recovery within the next 50 years. While all ecosystem function is important, this plan recognizes that finite resources require a focus on the most important habitat types first. Many stakeholders are responsible for recovering steelhead throughout Puget Sound. This plan provides a road map for how various stakeholders in East Kitsap are expected to play a role in the local recovery of steelhead, including city and county jurisdictions, Tribes, non-profits, and private landowners. The plan was developed and written for stakeholders involved in recovery. Communication to the general public will likely require additional messaging and outreach so that they understand what actions they can take to assist with recovery. Many of the strategies and actions identified in the plan will benefit not only East Kitsap steelhead, but other important populations that support the Suquamish Tribe's treaty rights and ecosystem functions that support multiple salmonid species.

Much of the East Kitsap DIP watershed is located within the exclusive Usual and Accustomed fishing area of the Suquamish Tribe, including Sinclair and Dyes inlets, and Liberty Bay. The Tribe has harvested treaty-reserved resources, including salmon, steelhead, and other finfish and shellfish, within this area since time immemorial. As a fishing people, the Tribe's cultural, spiritual, and economic well-being depends on the use and long-term health and sustainability of these resources.

This plan is developed with the following vision for steelhead recovery in East Kitsap:

> *We envision steelhead recovery in East Kitsap that results in: abundant, productive, diverse, and resilient steelhead and salmon populations that support ecosystem processes; an East Kitsap steelhead population that contributes to the viability of Puget Sound steelhead and that supports recreational, ceremonial, and subsistence harvest; an East Kitsap ecosystem that supports the full exercise of tribal treaty harvesting rights; the best and most productive stream systems and habitats being accessible, functioning, and in long term protective status; and significant progress in restoring impacted stream systems.*

1.2 Framework for Steelhead Recovery

The National Marine Fisheries Service (NMFS) listed Puget Sound steelhead as a threatened species under the Endangered Species Act (ESA) on May 11, 2007 (Federal Register 72(91):26722–26735). Puget Sound steelhead are considered a Distinct Population Segment (DPS), analogous to an Evolutionary Significant Unit (ESU) for other species. Several salmon and steelhead DPSs and ESUs are listed as threatened or endangered on the West Coast from Washington to Southern California. NMFS identified several factors to support the listing, including widespread declines in abundance and productivity for most natural steelhead populations in the Puget Sound DPS, the low abundance of several summer-run populations, and the sharply diminishing abundance of some steelhead populations.

In 2008, NMFS convened a Puget Sound Steelhead Technical Recovery Team (TRT) to define populations within the DPS. In 2013, NMFS released *Identifying Historical Populations of Steelhead Within the Puget Sound Distinct Population Segment* (NMFS 2013), and *Viability Criteria for Puget Sound Steelhead* was completed in 2014 (NMFS 2014). The TRT identified 32 populations of Puget Sound steelhead, which were aggregated into the following three major population groups (MPGs) based on analysis by NMFS's Technical Review Team: Northern Cascades MPG, Central and South Puget Sound MPG, and Hood Canal and Strait of Juan de Fuca MPG. The East Kitsap Demographically Independent Population (DIP) is within the Central and South MPG and the focus of this recovery plan. The hierarchy of steelhead population units in Puget Sound is further described in Section 2.

In 2014, NMFS formed the Puget Sound Steelhead Recovery Team (Recovery Team) to assist in preparing the Proposed Puget Sound Steelhead Recovery Plan. In addition to staff from NOAA, the Recovery Team included representatives from tribes, local governments, state agencies, and non-governmental organizations. NOAA released a final ESA Recovery Plan for Puget Sound Steelhead ("Regional Plan") in December 2019 (NMFS 2019). The Regional Plan states its purpose as guiding the efforts to improve the viability of Puget Sound steelhead at three spatial scales, the DPS, MPGs and DIPs. This East Kitsap DIP recovery plan constitutes a "chapter" for one steelhead population and will be included as an addendum to the Regional Plan to direct local recovery efforts. A draft version of the Puget Sound Steelhead Recovery Plan (NMFS 2018) was available and followed closely as a reference during the development of the East Kitsap DIP plan.

As articulated in the Regional Plan, the overarching approach for recovery of Puget Sound steelhead emphasizes several strategies; chief among them is protecting and restoring ecosystem functions and freshwater habitat and improving juvenile survival in Puget Sound waters. A complementary and important strategy is to ensure that fisheries management (harvest and hatcheries) is consistent with recovery. The following are the primary (qualitative) goals described in the Regional Plan (NMFS 2019).

- Achieve biological viability of the Puget Sound steelhead DPS.
- Conserve the ecosystems upon which the DPS depends such that it is sustainable, persistent, and no longer needs federal protection under the ESA.
- Address the five listing factors from Section 4(a)(1) of the ESA:
    a) The present or threatened destruction, modification, or curtailment of the species' habitat or range.
    b) Over-utilization for commercial, recreational, scientific, or educational purposes.

c) Disease or predation.

d) Inadequacy of existing regulatory mechanisms.

e) Other natural or human-made factors affecting the species' continued existence.

The Regional Recovery Plan was developed using Open Standards for the Practice of Conservation, a planning tool commonly used in Puget Sound and West Coast salmonid recovery planning. This approach identifies goals, prioritizes pressures, determines strategies to address the pressures, and develops an adaptive management approach for long-term implementation. Development of the East Kitsap Steelhead DIP recovery plan followed a similar process and builds upon the framework and contents of the Regional Plan to identify and use locally-relevant science and recovery strategies for the local planning process, while also incorporating locally derived information to further refine goals, identify additional pressures, and determine the local actions that are needed to address the pressures and stressors for steelhead in East Kitsap.

This plan uses the following simplified conceptual framework to develop and describe steelhead recovery in the East Kitsap DIP:

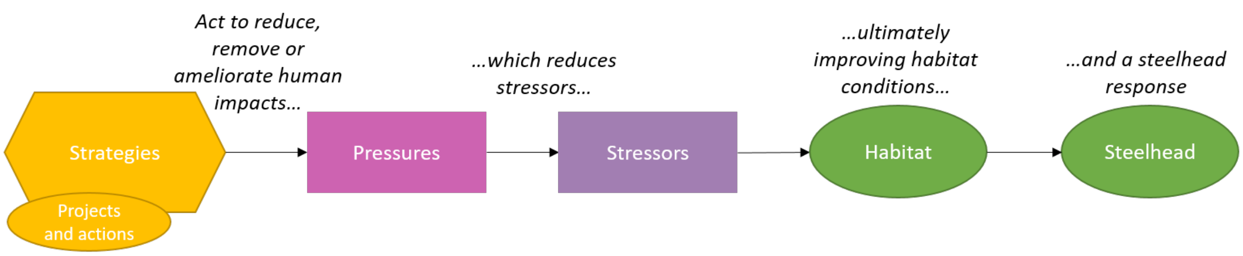

Figure 1-1. Conceptual Framework for Recovery

Figure 1-1 shows the approach to recovery with a simplified graphical relationship showing how recovery strategies reduce the human-caused pressures and stressors leading to ecological improvements in steelhead habitat and ultimately a positive steelhead response.

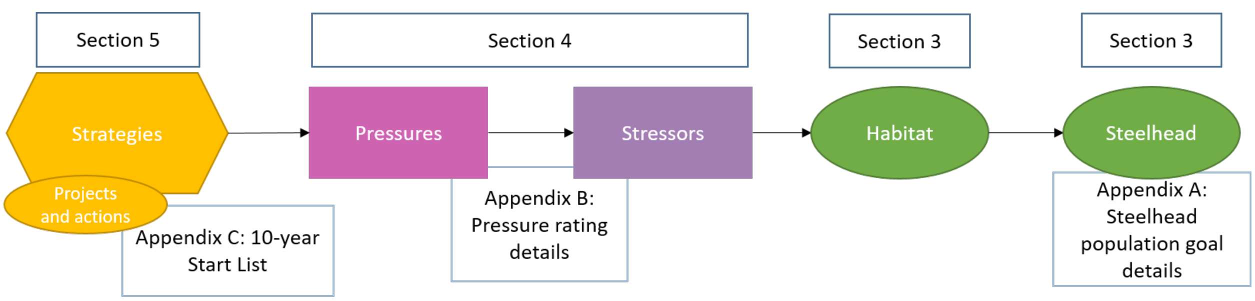

Figure 1-2. Location of Elements in Recovery Plan

Figure 1-2 shows where each element of the framework is further described in a specific section of the plan, and, in some cases, a more technical and detailed appendix.

1.3 Relationship to other Salmon Recovery Efforts

The East Kitsap steelhead DIP is part of the Central and South Puget Sound MPG and represents a single population among 32 DIPs in Puget Sound as identified by the TRT (Myers et al 2015). Geography in East Kitsap spans multiple governmental and administrative boundaries. Most of the DIP is located within Kitsap County; however, the south portion of the DIP is in Pierce County and the southeast portion is in King County (Figure 1-3).

Local implementation of Chinook salmon (*Oncorhynchus tshawytscha*) recovery efforts began over a decade ago guided by the Puget Sound Chinook recovery plan adopted by NOAA in 2007. There are no independent populations (no natal spawning rivers) of Chinook salmon in East Kitsap; therefore, the local strategies focus on the nearshore which supports early marine rearing and migration for multiple populations of Chinook and have a slightly different geographic boundary for management than the steelhead population. Because of differences in their biology and habitat use, the strategies for recovery differ in some respects for Chinook and steelhead. However, the local strategies developed for Chinook, particularly focused on nearshore habitat protection and restoration, yield benefits for other salmonids, including steelhead. The steelhead DIP boundary is slightly different than the Lead Entity boundary and includes Vashon Island which is included in WRIA 9 for Chinook recovery (Figure 1-3). Salmon recovery in East Kitsap is locally coordinated and implemented by the West Sound Partners for Ecosystem Recovery (WSPER) via projects and programs identified in the Puget Sound Chinook Recovery Plan (Shared Strategy), East Kitsap Watershed Chapter (Kitsap County et al. 2005). The 2005 East Kitsap (West Sound) chapter articulates the Lead Entity objectives for Chinook recovery as:

- Protect nearshore functions
- Restore shorelines
- Implement education and outreach
- Address culverts and fish passage barriers

More recently, recovery planning efforts within the East Kitsap DIP geographical area have included watershed assessments and restoration plans developed by the Suquamish Tribe for high priority watersheds, including the Curley Creek, Chico Creek, and Blackjack Creek watersheds, and an assessment and restoration plan for the Springbrook Creek watershed developed by the Bainbridge Island Land Trust and others. These efforts focused on developing individual watershed plans that identify strategies and actions that will protect and restore watershed, riparian, and floodplain ecological processes and function, and stream habitats. The watershed plans were used to inform the development of strategies and actions of this local recovery plan for the East Kitsap Steelhead DIP.

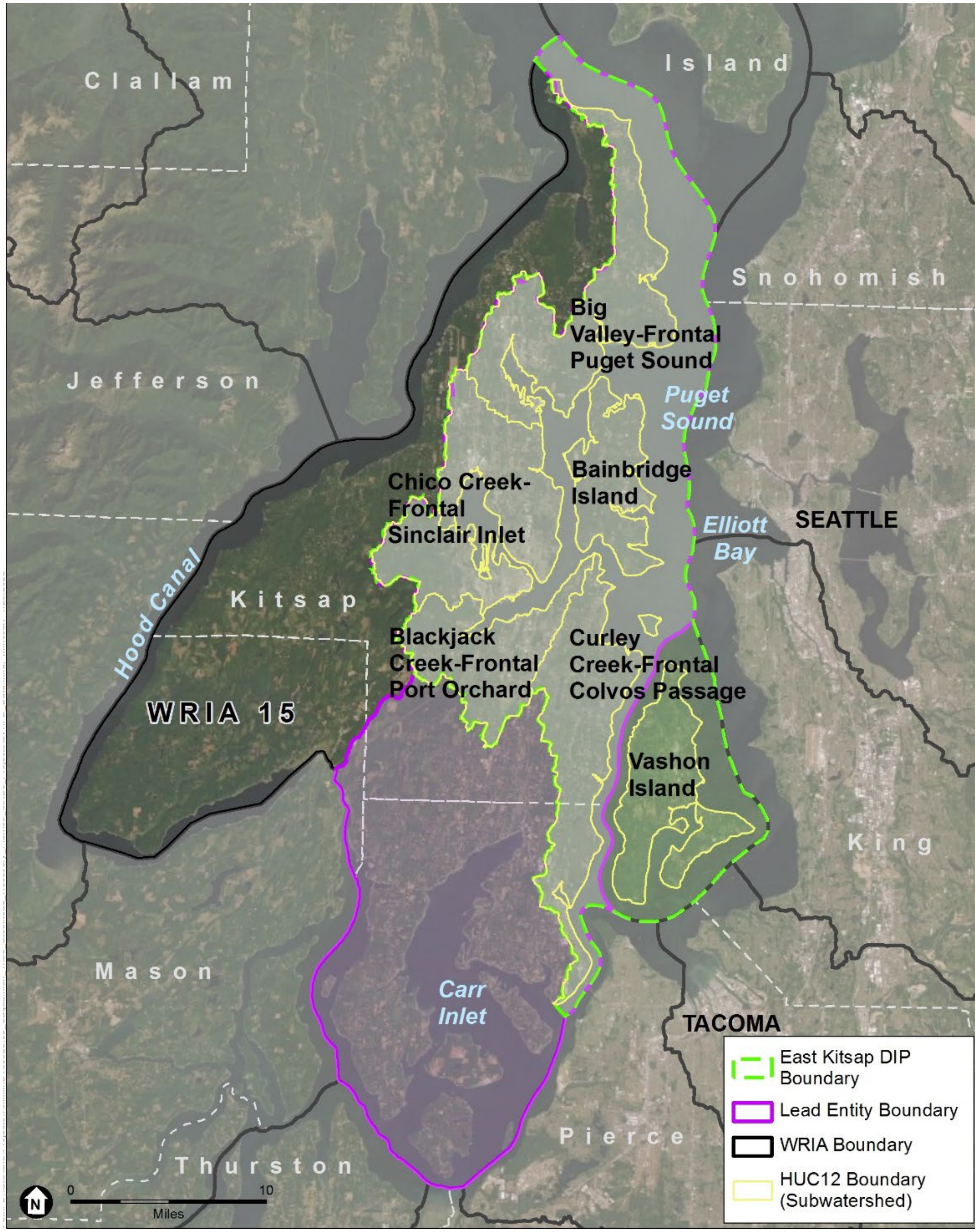

Figure 1-3. East Kitsap Steelhead DIP and Planning Boundaries

Salmon and steelhead recovery is part of the broader ecosystem restoration effort in the Puget Sound region, led by the Puget Sound Partnership's Action Agenda (2018). The Action Agenda defines nine Local Integrating Organizations (LIOs) that coordinate local actions; the East Kitsap DIP is part of the West Central LIO, which coordinates actions on the east side of the Kitsap Peninsula and consists of the following cities, counties, and tribes:

- Suquamish Tribe
- Kitsap County
- City of Bainbridge Island
- City of Bremerton
- City of Gig Harbor
- Pierce County
- Port Gamble S'Klallam Tribe
- City of Port Orchard
- City of Poulsbo

The West Central LIO, known as the West Sound Partners for Ecosystem Recovery (WSPER), consists of an Executive Committee and three working groups that focus on shellfish, stormwater, and salmon habitat. The salmon habitat subgroup for most of the East Kitsap DIP is the technical advisory group. The former lead entity (West Sound Watershed Council) and the West Central LIO have been combined into a single entity. The Water Resource Inventory Area 9 (WRIA 9) Watershed Ecosystem Forum, housed at King County, is the Lead Entity for Chinook recovery for Vashon Island subwatershed.

To develop this plan, the Suquamish Tribe used contractor support from Environmental Science Associates to gather and analyze information on steelhead population and habitat, develop goals, analyze pressures, and assist with the development of strategies and actions related to steelhead, as well as to convene stakeholders to review and discuss the information. Over the course of the project, the Tribe engaged stakeholders – both the Lead Entity and the West Central LIO – in several workshops and meetings and provided draft materials for review.

2 EAST KITSAP STEELHEAD

The following section describes the different scales of planning and management, and their relationship to regional and local steelhead populations and the planning units that have been defined for managing East Kitsap DIP recovery. Within this context, the section also includes a landscape overview of the East Kitsap DIP population unit, a description of steelhead biology, and information about historic and current distribution and abundance.

2.1 Recovery Planning/Steelhead Population Units

For the purposes of recovery, populations of salmon and steelhead are defined at various geographic and genetic scales. This is necessary for assessing the viability of individual populations, as well as identifying the number, location, and type (summer/winter steelhead) of individual viable populations necessary for viable Puget Sound steelhead at various spatial and genetic scales. Technical Recovery Teams (TRTs) have emphasized the importance of establishing viability parameters or criteria for both individual populations and groups of populations (Myers et al. 2015). Viability criteria describe what constitutes a viable salmonid population, based on the biological parameters of abundance, productivity, spatial structure, and diversity.

Within Puget Sound, populations, or groups of salmonid populations, have been defined to aid in the assessment of current and historical salmonid populations, and to guide recovery efforts. From largest to smallest scale, these groups include distinct population segments (DPSs), major population groups (MPGs), and demographically independent populations (DIPs).

A DPS is defined under the Endangered Species Act (“the Act”) and must meet tests of discreteness and significance according to policy established by the U.S. Fish and Wildlife Service (USFWS) and NMFS. A population is considered distinct (and hence a “species” for the purpose of conservation under the ESA) if it is discrete from and significant to the remainder of its species based on factors such as physical, behavioral, or genetic characteristics, it occupies an unusual or unique ecological setting, or its loss would represent a significant gap in the species’ range. The DPS relevant to this steelhead recovery plan is the Puget Sound DPS, which includes all demographically independent populations in watersheds that drain to Puget Sound, Hood Canal, and the east portion of the Strait of Juan de Fuca (NMFS 2016).

Another scale for the grouping of steelhead populations is the MPG, defined as a grouping of salmon populations that are geographically and genetically cohesive. The MPG is a level of organization between a DPS (coarser scale) and DIP (finer scale). The TRT identified three MPGs for steelhead in the Puget Sound DPS: Northern Cascades, Central and South Puget Sound, and Hood Canal and Strait of Juan de Fuca (Myers et al. 2015). The three MPGs are shown in Figure 2-1. MPG boundaries generally delineate major biogeographic regions with life-history differences, distinct ecological zones, or geographic structuring. The East Kitsap DIP is in the Central and South Puget Sound MPG.

Within the three MPGs, there are a total of 32 steelhead DIPs in Puget Sound (Figure 2-1). DIPs are the fundamental biological units and the smallest units for modeling viability. The definition used for determining steelhead DIPs is the same as that used in conservation assessments for other Pacific salmonids (McElhany et al. 2000). This definition is similar to that of a stock; an independent population is a group of fish of the same species that spawns in a location (lake or stream) at a particular season and which, to a substantial degree, does not interbreed with fish from any other group spawning in a different place or in the same place at a different season. Myers et al. (2015) assumed that a “substantial degree” means that two groups are isolated to such an extent that exchanges of individuals among the populations do not substantially affect the population dynamics or extinction risk of the independent populations over a 100-year period (McElhany et al. 2000). This recovery plan is focused on the East Kitsap Peninsula Tributaries Winter Run DIP, one of eight DIPs within the Central and South Puget Sound MPG. Figure 2-1 shows the East Kitsap DIP boundary (S1) in relation to the other populations in the DPS organized by MPGs (labeled as W, S and N).

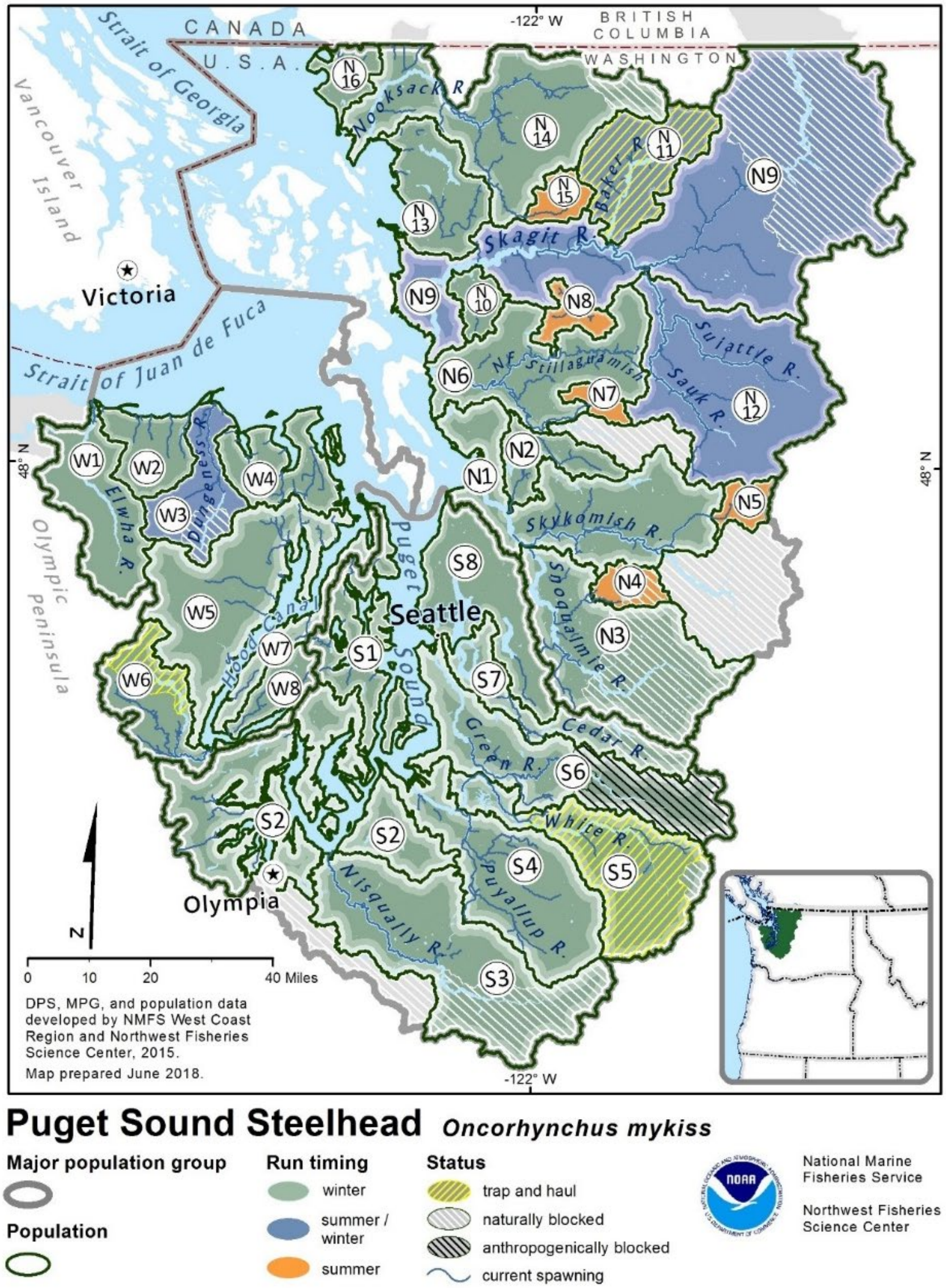

Figure 2-1. Puget Sound Steelhead DPS and Associated MPGs and DIPs (from NMFS 2019)

2.2 Landscape Setting

2.2.1 Central and South Puget Sound MPG

The Central and South Puget Sound MPG includes populations in the Lake Washington and Cedar River basins, in the Green, Puyallup, and Nisqually rivers, South Puget Sound, and East Kitsap Peninsula tributaries. This MPG includes portions of the Cascades at higher elevations as well as the Puget Lowlands Ecoregion. Although the headwaters of the large river systems are in higher elevation areas, most of these river basins also have extensive alluvial plains with characteristics ecologically similar to the smaller, independent lowland streams found in the South Sound and East Kitsap DIP geographies. The TRT identified the Central and South Puget Sound MPG as distinct based on the geographic discreteness of central and south Puget Sound from the other MPGs (Hard et al. 2015). There is a geographic break of 50 to 100 km between the nearest populations in the three MPGs.

Although some genetic information exists for steelhead in the major basins draining the Cascades, little information is available on steelhead occupying neighboring smaller, lowland rivers (including the East Kitsap DIP). Recent genetic analysis indicates that sampled populations in this MPG clustered together on a scale similar to those in the other MPGs (Hard et al. 2015). The MPG contains only winter-run steelhead populations, although anecdotal information suggests that summer-run steelhead populations may have existed in headwater areas of some larger rivers.

To evaluate progress toward recovery of Puget Sound freshwater habitat, NMFS (Beechie et al. 2017), developed a habitat monitoring program for four distinct environments of Puget Sound: large rivers, floodplains, deltas, and the nearshore. This program included the development of a hierarchical sampling design to monitor habitat status and trends, and the identification of habitat metrics related to Viable Salmonid Population (VSP) parameters with protocols to measure these metrics. This analysis did not include higher elevation or independent tributaries or lowland small streams important for steelhead because the focus was initially on Chinook habitat. However, the study does summarize their findings using the three steelhead MPGs and provides a useful, if incomplete, summary of relative habitat quality demonstrating that the South and Central MPG has higher levels of land use development than elsewhere.

The mean values for many of the metrics evaluated were similar across steelhead MPGs; however, some metrics varied substantially between MPGs (Beechie et al. 2017). Of the three steelhead MPGs analyzed, the Central and South Puget Sound MPG has the lowest percentage of lands classified as agriculture (10%), as well as the highest percentage of developed lands (28%), which in turn contributes to the MPG also having the lowest average buffer width of the three MPGs. Habitat edge length by bank type was also the most impacted in the Central and South Puget Sound MPG, with the lowest natural bank edge length (37%) and the highest modified bank edge length (35%). Lastly, the Central and South Puget Sound MPG has the greatest amount of developed delta among all three MPGs.

2.2.2 East Kitsap Peninsula Tributaries Winter Run DIP

The East Kitsap DIP geography is made up of independent tributaries of varying sizes on the east side of the Kitsap Peninsula and Bainbridge and Vashon islands. There are no glaciers or large rivers, and none of the individual tributary streams are dominant in the DIP. The entire steelhead population lies within the Puget Lowlands Ecoregion, with headwater areas that drain low hills and streams with a rain-dominated hydrograph. These streams have naturally low summer flows (Haring 2000; Nash 2017), which may be further reduced by changes in land use patterns over the last century. Many of these streams currently fail to meet instream flows and are seasonally closed to consumptive use. Marine biogeographic barriers at Point No Point and the Tacoma Narrows may influence the demographic isolation of this DIP.

In a recent evaluation of steelhead habitat, Nash (2017) examined six individual watersheds within the East Kitsap Peninsula (WRIA 15 East), consisting of Hydrologic Unit Code (HUC) watersheds, as defined by 6th level (12-digit) hydrologic unit boundaries from the Watershed Boundary Dataset (WBD) layer for Washington (Figure 1-3). Within these six subwatersheds, Nash (2017) summarized several key components, including location, annual precipitation, land use, floodplains, wetlands, spawning ground surveys (when available), stream types and lengths, fish presence and use, and intrinsic potential modeling results. A seventh watershed, Vashon Island, is also included in the East Kitsap DIP, although this watershed was not analyzed by Nash (2017).

The seven subwatersheds that make up the East Kitsap DIP are as follows:

- Big Valley-Frontal Puget Sound (Big Valley-Dogfish subwatershed)
- Barker Creek-Frontal Dyes Inlet (Barker-Dyes subwatershed)
- Chico Creek-Frontal Sinclair Inlet (Chico-Frontal Sinclair subwatershed)
- Blackjack Creek-Frontal Port Orchard (Blackjack subwatershed)
- Curley Creek-Frontal Colvos Passage (Curley-Colvos subwatershed)
- Bainbridge Island
- Vashon Island

2.3 Steelhead Biology and Current Information

The following section describes the life history strategies of steelhead as well as the current understanding of historic abundance of the Puget Sound DPS. While there is a paucity of local steelhead data, the available information on how steelhead utilize habitat within East Kitsap and the primary steelhead streams are identified based on limited observations and the knowledge from area biologists.

2.3.1 Life History

Puget Sound steelhead exhibit one of the most complex life-history strategies of any of the anadromous Pacific salmonid species. Steelhead may be either anadromous or freshwater residents (which are usually referred to as rainbow trout). Biologically, steelhead can be divided into two reproductive ecotypes: “stream-maturing” and “ocean-maturing.” Stream-maturing, or summer-run steelhead, enter freshwater as returning adults in a sexually immature condition and require several months to mature and spawn. Ocean maturing, or winter-run steelhead, enter freshwater as returning adults with well-developed gonads and spawn shortly after river entry. Puget Sound steelhead usually spend 1 to 3 years rearing in freshwater, with most typically spending 2 years before migrating to the ocean (Busby et al. 1996).

As in other Puget Sound streams, winter-run steelhead likely return as adults to East Kitsap DIP streams from December to April and likely spawn between February and May, with peak spawning thought to occur from mid-April through May (Haring 2000; PSP and WDFW 2011). Depending on temperature, steelhead eggs incubate in redds for 1.5 to 4 months before hatching. Puget Sound steelhead typically smolt after 2 years, although they may spend 1 to 4 years in freshwater. Thus, the species relies heavily on freshwater habitats and is present in streams year round. Upon entering saltwater, steelhead smolts in

Puget Sound make a 6 to 18-day migration to the Pacific Ocean (Moore et al. 2015). Unlike other salmonid outmigrants in Puget Sound, steelhead do not appear to utilize pocket estuaries or nearshore habitat as they rapidly migrate through Puget Sound and Hood Canal to the Strait of Juan de Fuca. They then typically reside in the marine waters of the Pacific Ocean for 2 or 3 years prior to returning to their natal stream to spawn. Steelhead are iteroparous (characterized by multiple reproductive cycles over the course of their lifetime), but rarely spawn more than twice before dying; those that do so are almost exclusively females (PSP and WDFW 2011). Adult fish are called kelts; they migrate back to saltwater before returning to spawn again. Figure 2-2 shows a generalized life cycle for Puget Sound steelhead. A more complex figure showing the multiple life cycle pathways for steelhead is available in the Regional Plan (2019).

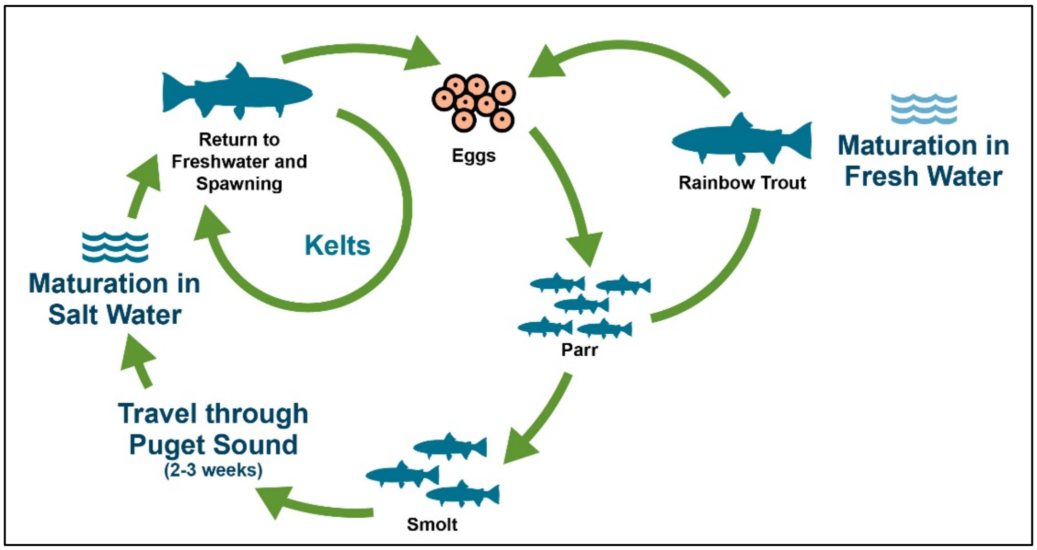

Figure 2-2. Generalized Life Cycle for Puget Sound *Oncorhynchus mykiss*

Prior to spawning, maturing adults hold in pools or in side channels to avoid high winter flows. Steelhead tend to spawn in moderate to high gradient sections of streams and spawn higher in the watershed compared to other salmonids. Newly emerged fry move to shallow, protected areas of the stream (usually along the stream margins) and establish feeding areas that they defend. Most juveniles are found in riffles, although larger fish move to pools or deep runs in late summer. Juvenile steelhead are less dependent on pools or off-channel areas than other salmonids, such as coho salmon. Larger, older steelhead in smaller tributaries of mainstem systems likely move out to overwinter in the mainstem. Overall, juvenile steelhead often reside in freshwater for longer periods than juveniles of other anadromous salmonids and are thus more susceptible to changes in habitat quality that may lower their freshwater survival rate (Scott and Gill 2008).

The habitat needs described above are largely based on steelhead in larger river systems in Puget Sound, and more work is needed to better understand how steelhead use smaller tributary systems. However, based on the current understanding of freshwater habitats and the importance of cool, clean, and abundant water for steelhead, the following habitat types are considered critical for recovering the East Kitsap DIP:

connected floodplains and side channels; complex and accessible in-stream habitat; intact riparian areas; forested uplands; and functional wetlands. The pressures and stressors that impact these and marine habitats are described in Section 4. The recovery goals for these habitat types are described in Section 3.

2.3.2 Historical Abundance

Gayeski et al. (2011) estimated the total Puget Sound steelhead adult abundance in 1895 as between 485,000 and 930,000. This compares to a 25-year average abundance for all of Puget Sound of 22,000 for the 1980 to 2004 period, indicating that current abundance is likely only 2 to 5% of the abundance immediately prior to the 20th century.

NMFS used historic commercial fisheries catch data circa 1895 (Wilcox 1898), previously analyzed by Hard et al. (2007), to estimate historic abundance of each of the 32 DIPs of Puget Sound steelhead (Myers et al. 2015). Hard et al. (2007) estimated a total historic abundance of adult steelhead of 327,592–545,987, assuming a 30–50% harvest rate and approximately 12 lbs. per fish. The midpoint of this range (N = 436,790 adult steelhead) was used as the historical abundance estimate. The total abundance was then allocated to the 32 constituent populations, based on proportional estimates of historic habitat availability in linear stream length. The estimates of habitat availability were initially generated from the intrinsic potential model of steelhead habitat (Hard et al. 2015) and modified based on feedback from steelhead biologists in a series of meetings throughout Puget Sound. That effort resulted in an estimate of historic steelhead habitat for the East Kitsap DIP of 117 river miles, yielding a historic abundance for the DIP of 12,448 adult steelhead.

Preliminary analyses of adult abundance trends for wild steelhead (and wild and hatchery smolt-to-adult survival rates) suggest that steelhead populations along the Pacific Coast, from British Columbia through Oregon, share a pattern of declining abundance from the mid-1980s through the mid-1990s (Myers et al. 2015). It also appears that steelhead distribution may be shrinking on the Kitsap peninsula (PSEMP 2012). The shared pattern suggests that common, Pacific region-level factors such as climate and ocean conditions are driving survival and that juvenile steelhead mortality in the Puget Sound marine environment constitutes a major, if not the predominant, factor in that decline.

2.4 Current Distribution

Steelhead have been documented in all seven of the East Kitsap DIP subwatersheds, although distribution appears very limited in the Bainbridge Island and Vashon Island subwatersheds and moderately limited in the Big Valley and Barker-Dyes subwatersheds (WDFW 2018a & b; Haring 2000). While no additional surveys were conducted during plan development and new information continues to be gathered, the assumption is that many of the drainages currently support small numbers of anadromous steelhead (WDFW 2018a and b; J. Oleyar, pers. comm.). Nearly half of all historical steelhead-bearing stream miles within the DIP are distributed within three subwatersheds: Curley-Colvos, Blackjack, and Chico-Frontal Sinclair (see Appendix B, Table 8). The remaining half of steelhead-bearing stream miles are distributed in the remaining four subwatersheds, with several subwatersheds (Bainbridge Island and Vashon Island) having minimal steelhead distribution (0.4 and 1.6 stream miles respectively).

Similarly, nearly 50 percent (26 stream miles) of the total current steelhead distribution in the DIP (56 miles) is within three drainages: Chico, Curley, and Blackjack creeks. Three other drainages (Gorst, Olalla, and Crescent creeks) account for nearly 20 percent (10 stream miles) of the steelhead-occupied stream miles in the DIP. The remaining 12 drainages have steelhead distribution ranging from 0.1 to 2 stream miles per drainage, accounting for the remaining 35 percent (20 stream miles) of steelhead occupied streams in the DIP.

In recent years, Wild Fish Conservancy has implemented environmental DNA (eDNA) assessments in watersheds throughout Puget Sound including the East Kitsap DIP (Wild Fish Conservancy 2018a). These assessments help fill data gaps about the presence, spatial and temporal distribution of steelhead and also support existing datasets through confirmation; however, eDNA does not confirm the absence of steelhead. A map of the eDNA assessments are available on their website (wildfishconservancy.carto.com/viz/88884c9a-1868-46bc-8a6a-fc91ebffeb10/embed_map). A recent evaluation of steelhead habitat by Nash (2017), concluded that the four streams with the greatest steelhead productions are Gorst, Chico, Curley, and Blackjack creeks, based on fish presence indicators and limited spawning ground survey data. Quantitative and qualitative information about habitat conditions, including intrinsic potential, refugia, wetlands, and fish passage barriers within the seven subwatersheds and the major steelhead drainages (majority from Nash 2017) were summarized in an existing conditions report, which was developed in preparation of this recovery plan (*East Kitsap DIP Synthesis Report,* ESA 2018).

Other salmonid species with documented presence in the DIP include Chinook, coho, fall and summer chum salmon, and resident and sea-run coastal cutthroat trout (WDFW 2018a; Haring 2000). The distribution of these species overlaps with steelhead in many cases, although their distribution, especially for coho and chum salmon, may be wider than that of steelhead in the number of streams occupied in East Kitsap DIP. Where they collocate, steelhead may distribute higher in the systems.

2.5 Current Abundance and Productivity

There is limited information for steelhead abundance in the East Kitsap DIP, and WDFW has not made escapement estimates for this population (WDFW 2018b). There are no quantitative estimates of winter steelhead in the East Kitsap DIP drainages, but abundance is assumed to be persistently low in recent years. Catch records are also lacking, with the exception of Curley Creek, which had an average annual sport catch of 15.4 fish (range 0–68) from 1959 to 1970 (WDG no date-b). A few individuals are observed in East Kitsap DIP streams but are rare, and spring surveys are not generally conducted (J. Oleyar, pers. comm.). The Suquamish Tribe and WDFW (2016) have made limited observations during spawning surveys in index and supplemental reaches, usually targeting other species such as chum or coho. A summary of this limited data set, from 1984 to 2010, is presented in Table 2-1. Observations for Chico, Gorst, Blackjack, and Curley creeks cover between 9 and 14 spawning seasons, while data for the remaining streams in the East Kitsap DIP are extremely limited, representing only a few spawning seasons.

Numerous other smaller tributaries within the East Kitsap DIP have been identified as supporting spawning steelhead via redd surveys in the 1980s, although there are no specific estimates of production. Redds were observed in various streams from February to April (Zischke 2011). Intrinsic potential estimates for this DIP are relatively low, 1,557 to 3,115 adult steelhead (Hard et al. 2015), especially given the relatively large basin size (678 km^2). Although some TRT members were concerned that the estimated historical abundance within this DIP was relatively low for sustainability, most of the TRT considered that the geographic isolation of this area was complete enough to ensure demographic independence.

Hard et al. (2015) estimated the current viability for the East Kitsap DIP. In this context, a self-sustaining viable population is defined as a population with a negligible risk of extinction due to reasonably foreseeable changes in circumstances affecting its abundance, productivity, spatial structure, and diversity characteristics, and that achieves these characteristics without dependence on artificial propagation, which increases the uncertainty of the viability estimate. Viability incorporates all VSP parameters and determines a low, moderate and high score for each parameter and a summary rating for each DIP, MPG and the DPS. The overall viability estimate for the East Kitsap DIP is low, as are the viability estimates for the other seven DIPs in the Central and South Puget Sound MPG, which extends to the overall MPG. However, the East Kitsap DIP has insufficient data on steelhead adult and juvenile abundance, productivity, genetic diversity, and spatial structure (see Section 8, *Data Gaps and Information Needs*). Spatial structure, as measured by intrinsic potential, was rated as moderate for the East Kitsap DIP for both spawning and rearing intrinsic potential (Hard et al. 2015).

Table 2-1. Steelhead Observations (1984–2010) from WDFW and the Suquamish Tribe in the East Kitsap DIP

Subwatershed	Stream	Years Surveyed	Survey Timing	Live Steelhead	Dead Steelhead
Big Valley	Grovers Creek	*Not surveyed*	-	-	-
	Dogfish Creek	4 (between 1995 and 2003)	Nov to March	0	1
	Big Scandia Creek	2 (1999 and 2000)	April and May	0	0
Barker-Dyes Inlet	Steele Creek	3 (between 1998 and 2006)	Dec to April	1	1
	Barker Creek	4 (between 1995 and 2000)	March, April	1	0
	Clear Creek	3 (1999 to 2001)	March, April	3	0
	Strawberry Creek	*Not surveyed*	-	-	-
Chico- Sinclair Inlet	Chico Creek	11 (between 1987 and 2005)	Nov to April	18	0
Blackjack	Blackjack Creek	9 (between 1984 and 2004)	Sept to April	13	2
	Gorst Creek	14 (between 1985 and 2010)	July to April	36	3
	Ross Creek	*Not surveyed*	-	-	-
	Anderson Creek	3 (between 1980 and 1988)	Dec to Jan	3	1
Curley-Colvos	Curley Creek	9 (between 1984 and 2003)	Jan to April	15	0
	Olalla Creek	4 (between 1984 and 2006)	Jan	3	1
	Crescent Creek	2 (1992 and 1999)	Nov and Jan	1	2
	Salmonberry Creek	*Not surveyed*	-	-	-
Bainbridge Island	Springbrook Creek	*Not surveyed*	-	-	-
Vashon Island	Judd Creek	*Not surveyed*	-	-	-
	Christiansen Creek	*Not surveyed*	-	-	-

3 RECOVERY GOALS

For recovery planning processes, it is important to develop goals to identify the desired future state of steelhead and habitats. The vision statement grounds the plan in an overall purpose, while the goals provide clear milestones for tracking progress toward that vision. The process of setting goals provides a useful framework as recovery partners consider historic conditions, assess available data, and articulate a shared statement about recovery. Goals are science-driven and become useful communication tools in tracking progress. Ideally, goals are quantitative, but qualitative goals are also useful if data is lacking. Through the ongoing process of adaptive management, more specific goals can be developed as information gaps are filled. The summary population and habitat goals are described below, while the detailed process describing how the population goals were developed is in Appendix A.

3.1 Hierarchical Organization for Recovery Planning

During the development of recovery goals, an early consideration was identifying the appropriate management units (e.g., stream drainage, subwatershed, DIP). For fish abundance or habitat goals specific to streams (e.g., accessibility), the appropriate management unit identified was stream drainage. For habitat goals specific to landscape controls (e.g., forest cover), the appropriate management unit identified was subwatershed. For all remaining habitat goals, the appropriate management unit identified was individual stream drainages and the entire DIP, which were then organized into priority tiers based on extent of current and the best estimate of historically available steelhead habitat.

Table 3-1 displays the hierarchical organization of management units used for developing fish abundance and habitat goals. These units are also used to connote priority or sequencing of strategies and actions in the plan. Note that the Vashon Island subwatershed is in King County and has not been included in previous analyses by Kitsap County or the Lead Entity. While the subwatershed is included in the plan, additional information and coordination with King County will be necessary for managing steelhead.

The steelhead streams in each subwatershed are based on existing steelhead distribution and an analysis of intrinsic potential by Nash (2017). The steelhead streams or drainages are separated into tiers based on historic steelhead stream miles. These were initially used for determining the population recovery goals and assigning different smolt to adult return rates (Appendix A). The separation into tiers is based on length of historic steelhead stream miles. Tier 1 drainages have over 7.5 miles of historic steelhead stream miles (Chico Creek has the most at 15.50 miles); Tier 2 drainages have over 3 miles of historic steelhead stream miles, and Tier 3 have less than 3 miles.

Table 3-1. Drainages in the East Kitsap DIP Geography

Subwatershed	Drainages by Tier
Big Valley – Dogfish	Tier 1: Grovers
	Tier 2: Dogfish, Big Scandia
	Tier 3: Carpenter, Doe-Kag-Wats, Lemolo, Thompson, Bliss, Cowling
Barker – Dyes	Tier 1: Clear
	Tier 2: Barker, Steele, Strawberry
	Tier 3: n/a
Bainbridge Island	Tier 1: n/a
	Tier 2: n/a

Subwatershed	Drainages by Tier
	Tier 3: Springbrook/Fletcher, Issei
Chico-Frontal Sinclair	Tier 1: Chico
	Tier 2: n/a
	Tier 3: n/a
Blackjack	Tier 1: Blackjack, Gorst
	Tier 2: Ross
	Tier 3: Anderson, Baileys, Karcher/Annapolis
Curley-Colvos	Tier 1: Curley/Salmonberry
	Tier 2: Olalla, Crescent
	Tier 3: North/Donkey, North Fork Olalla
Vashon Island	Tier 1: n/a
	Tier 2: n/a
	Tier 3: Judd, Christensen

While the DIP has been organized in a hierarchy that identifies Tier 1, 2, and 3 drainages to connote priority, it is important to note that conditions need to improve everywhere in order to recover steelhead. The critical habitat designated by NMFS for the Puget Sound Steelhead DPS is present within all seven subwatersheds of the East Kitsap DIP (NMFS 2016). The tiering system provides a tool to focus finite resources in the areas most likely to provide the most immediate benefit for increasing abundance and productivity for steelhead.

Tiering should be used in the development of future projects and as guidance in prioritization rather than a strict requirement. Projects in lower tiers are considered when consistent with the recovery strategies and where there is a demonstrated need. This is just one element of prioritization. Projects will be considered individually and weighed against the benefit of other projects in a grant round or other process considerations.

For the viable salmonid parameters (VSP) of spatial structure and diversity, it will be critical to ensure that steelhead can access sufficient habitat throughout the East Kitsap geography. A diverse population will exhibit a variety of sizes, different migration times out to Puget Sound and returning to freshwater, different lengths of freshwater rearing time, display iteroparity (i.e., return to spawn a second time in future years), and use of various habitats contributing to a resilient population. Similarly, accessing spawning and rearing habitat in streams throughout East Kitsap will result in increased resiliency and lead to a viable population.

Figures 3-1 (North), 3-2 (Central), and 3-3 (South) display the subwatersheds and drainages by tier in the East Kitsap DIP.

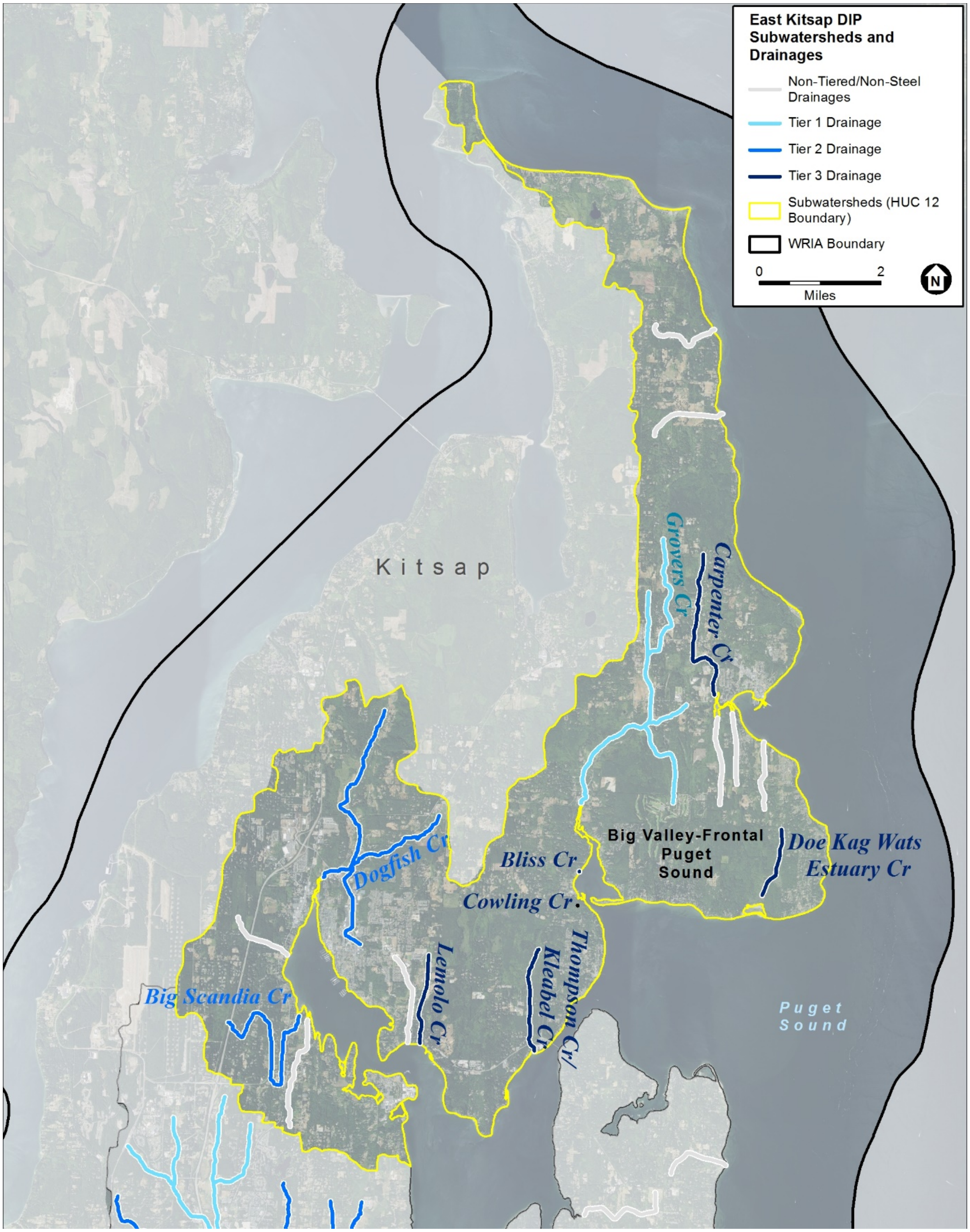

Figure 3-1. East Kitsap DIP Subwatersheds and Drainages – North

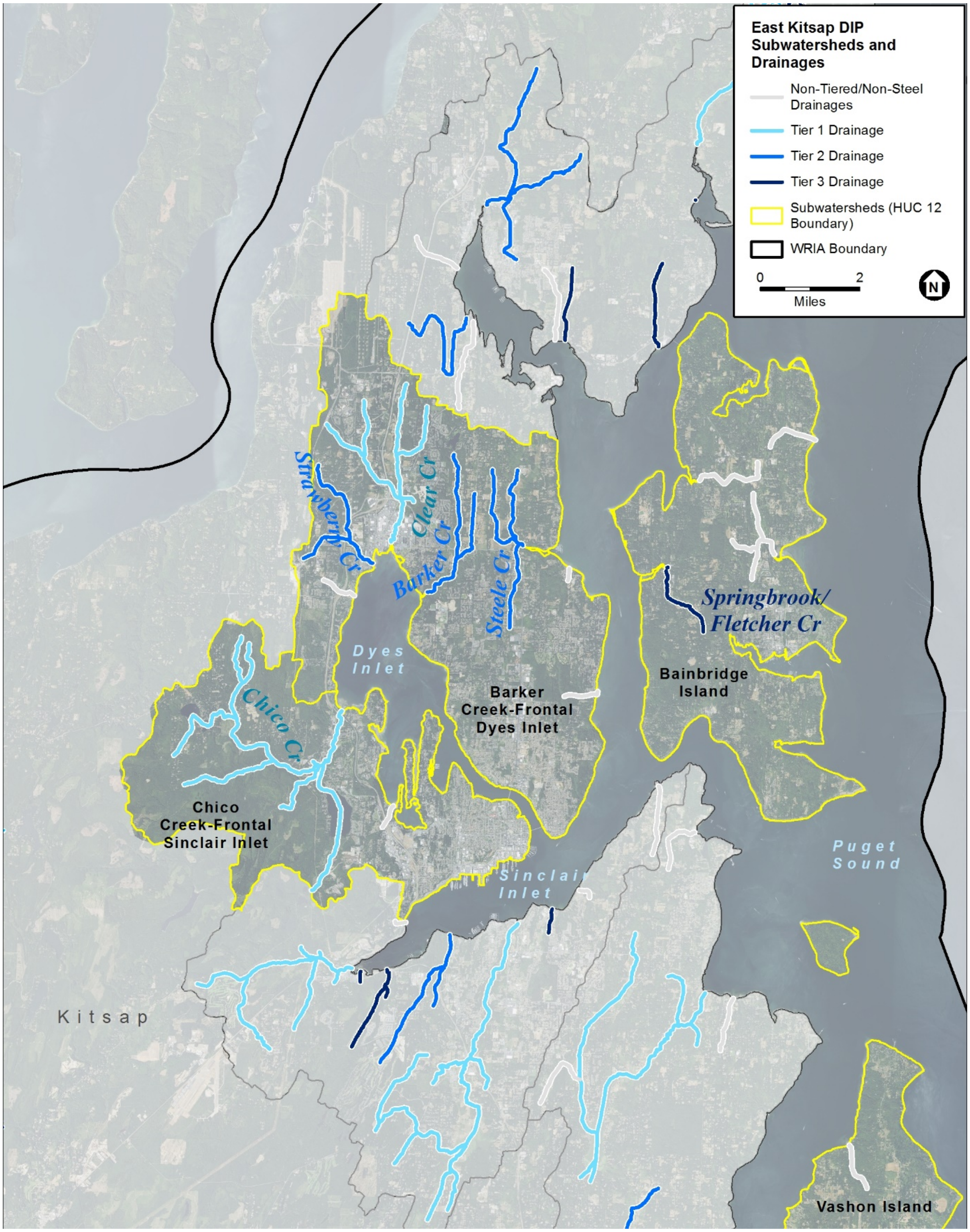

Figure 3-2. East Kitsap DIP Subwatersheds and Drainages – Central

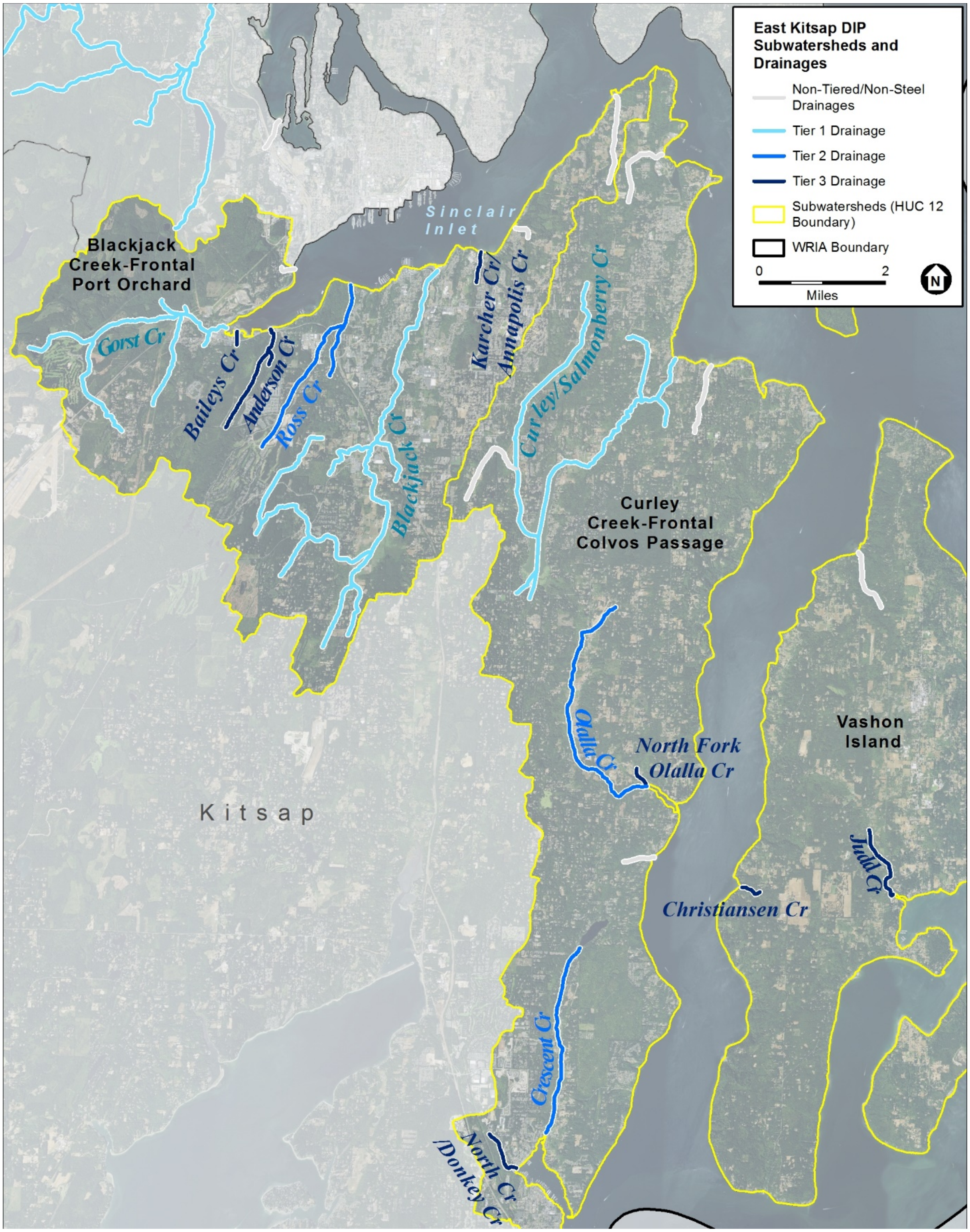

Figure 3-3. East Kitsap DIP Subwatersheds and Drainages – South

3.2 Population Goals

The locally approved goals for the East Kitsap steelhead population are summarized in the following table with explanation below and further detailed in the population goals technical memo (Appendix A).

Table 3-2. Differences Between Regional Plan Goals and Locally Developed Goals

	S_0 (equilibrium abundance)	S_{MSY}	R_{MSY}/S_{MSY}	Smolt to adult rate	*b* – density dependent parameter (recruits)	R_{MSY} (recruits at MSY)
Regional Plan	8,700	2,601	2.35	0.05	10,633	6,100
Local Plan	3,000	841	2.62	0.06	3,536	2,200

Population goals for the Regional Plan were developed based on guidance provided by the technical memo "Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units" (McElhany et al. 2000). The guidance defines any independent population of Pacific salmon or steelhead that has a negligible extinction risk due to demographic, environmental, and genetic changes over a 100-year time frame as a Viable Salmonid Population (VSP). The recovery status of any independent population (like the PS Steelhead DPS) is described by four VSP parameters: abundance, productivity, spatial structure, and diversity.

The Regional Plan establishes guidance and targets for recovery at three hierarchical spatial scales: at the smallest scale, there are 32 Demographically Independent Populations (DIPs) for which there is substantial reproductive isolation. The 32 PS steelhead DIPs are aggregated into three Major Population Groups (Hood Canal and Strait of Juan de Fuca, Central and South Puget Sound, and North Cascades) based on shared genetic, geographic, or habitat characteristics. For viability of the PS steelhead DPS, all three MPGs must be viable. The viability of each MPG is uniquely determined by the number and distribution of its component viable DIPs.

For abundance and productivity, the Regional Plan adopts the approach taken for PS Chinook salmon and sets goals based on choosing a high end of 70% of estimated historic abundance. Paired abundance and productivity goals were represented by a stock recruit curve (Beverton-Holt) with the equilibrium spawner abundance (S_0) set to 70% historic, and the low spawner abundance goal set to the maximum sustained yield abundance (S_{MSY}). For PS Steelhead, the Regional Plan used the earliest available catch records and estimated an historic abundance for the entire Puget Sound DPS to be 436,970 adults (Hard et al. 2007). The plan then allocates this total abundance estimate to the 32 Demographically Independent Populations (DIPs) based on proportional estimates of historic available linear freshwater habitat. Historic habitat length in the East Kitsap DIP area was estimated to be 2.8% of the total historic habitat length for the entire Puget Sound DPS. Applying this proportion of habitat to the total historic abundance results in a historic abundance estimate for the East Kitsap DIP of 12,448 (NMFS 2019).

The Tribe and consultant team believe the approach taken in the Regional Plan overestimates historic abundance for the East Kitsap DIP. Freshwater habitat in the geography of the East Kitsap DIP is made up of many small, low elevation, rain-dominated independent stream systems draining directly to Puget Sound. During summer, the area of wetted habitat suitable for steelhead rearing is greatly limited and is likely more reduced than in larger systems with greater watershed areas and where snow and glacial melt water contribute to base flows. Indeed, in contrast to the Regional Plan and utilizing estimates of stream gradient and habitat area, Myers et al. (2015) estimated the proportion of Kitsap freshwater steelhead habitat to be 0.5% of the Puget Sound total.

To address this difference in watershed and stream characteristics, the Tribe and consultant team utilized an alternative method to estimate high end smolt and adult abundance in the East Kitsap DIP. The approach is summarized here and more fully described in the technical memorandum contained in Appendix A. To better evaluate the smolt capacity of steelhead habitat in the East Kitsap area, the Tribe and consultant team utilized outmigrant smolt data from 2 nearby stream systems of similar size, hydrologic, geological, and habitat characteristics, Big Beef Creek (37 years of data) and Snow Creek (36 years of data). Smolt densities observed in Big Beef Creek and Snow Creek are similar and range from a minimum of 28 smolts per mile to 326 smolts per mile (mean densities were 184 and 158, respectively). Using a smolt density at slightly above the high range of Big Beef and Snow creeks (350 smolts per mile), extrapolating to available habitat in East Kitsap, and applying a smolt to adult return rate (SAR) of 6% (the high end SAR for the period of record) yields a total abundance at the high end of 3041 spawners. This value is consistent with Myers et al. estimate of 1557 – 3115 historic adult abundance. For setting abundance and productivity goals, the Suquamish rounded this result and utilized a high end adult abundance of 3000 spawners.

To parameterize the Beverton-Holt function for the East Kitsap DIP, the equilibrium abundance was set to our high end adult abundance estimate of 3000 spawners. Intrinsic freshwater productivity was set to 110 smolts/spawner (Buehrens 2017), and smolt to adult return rate (marine survival) was set to 6%. This produces the population abundance curve shown in Figure 3-4. Table 3-2 summarizes the differences between the local approach taken here and the Regional Plan’s abundance and productivity goals.

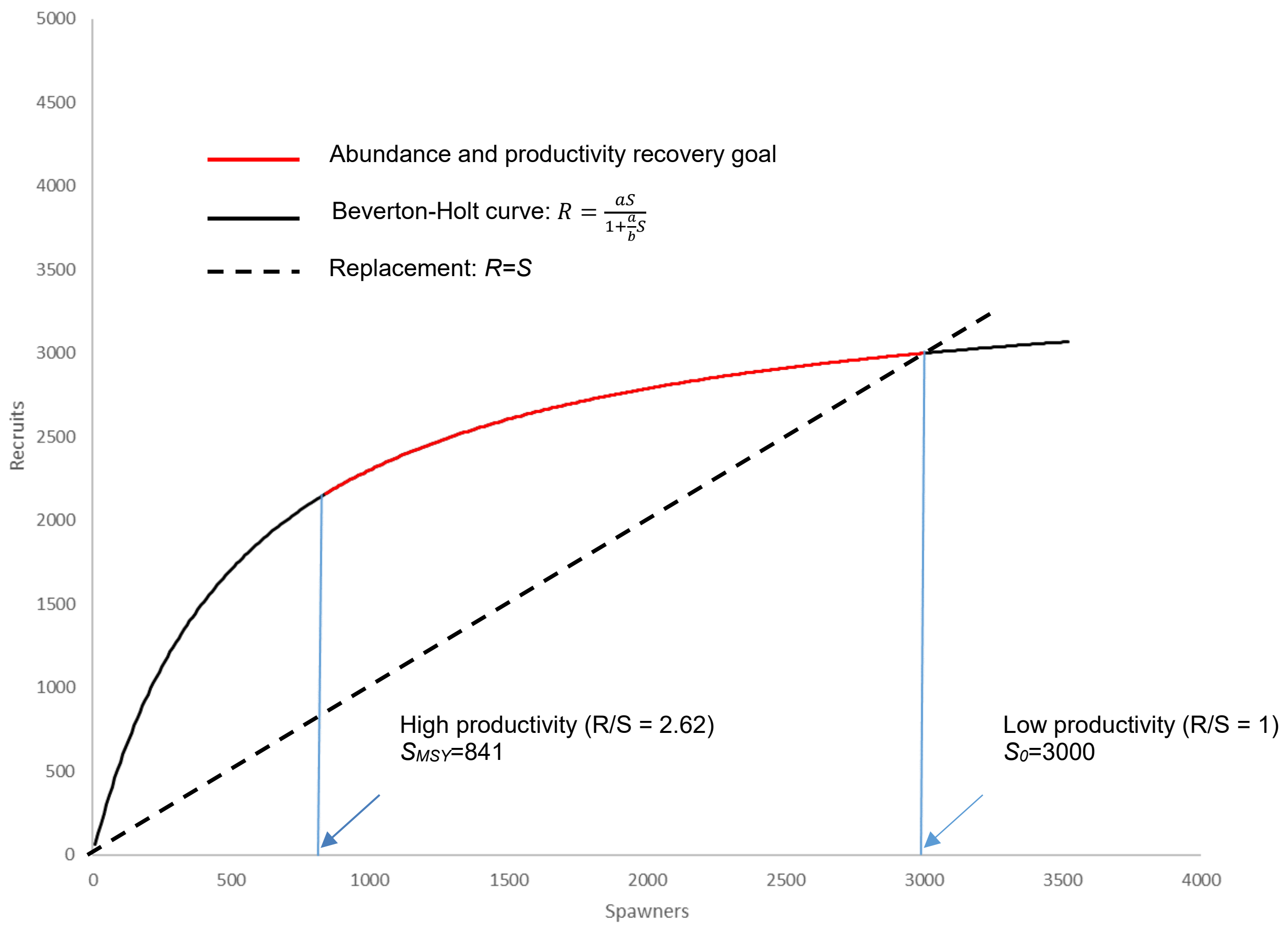

Figure 3-4. Beverton-Holt Recovery Goal Curve for East Kitsap DIP

Very little information exists concerning current and historical population status (abundance, productivity, etc.) of the East Kitsap DIP. This makes establishing quantitative population goals challenging. To establish abundance and productivity goals, the Tribe and consultant team adopted an approach that utilized empirical data, albeit contemporary, from two nearby watersheds that are physically similar to those found in the East Kitsap DIP geography. These goals should be regarded as subject to modification as information about local habitat and steelhead population conditions is developed. Population monitoring ("fish-in, fish-out") called for in this plan (see Section 7) is a critical component of adaptive management and will aid in refining and validating long-term population goals for the East Kitsap DIP.

3.3 Habitat Goals

The process of setting long-term habitat recovery goals started by identifying the most important habitats for steelhead in the East Kitsap DIP based on current understanding of the biology and ecology of the species. The Tribe and consultant team identified the key habitat types to develop extent and/or condition goals to articulate what will be necessary for steelhead recovery. The team assessed existing information and developed draft goal statements for review and revision by salmon recovery partners. The West Sound Partners for Ecosystem Recovery technical advisory group (TAG) helped identify the highest priority habitat types and available information to support goal setting, and vetted the goal language over a series of meetings. Where there was enough quantitative information to support a specific goal, those are included; however, some goals remain qualitative and would benefit from additional specificity in the future. All goal statements below assume a 50-year planning horizon (2070) with earlier benchmarks if relevant (e.g., fish access). Recovery partners agree that progress cannot wait for 2070, and that it is important to move quickly toward these goals for continued/improved ecosystem function and steelhead recovery. More detailed implementation targets developed to track progress toward reaching these goals are described in Section 6.

Because habitat goals are based on our best current understanding of steelhead life histories and how they use the ecosystem, the goals should be refined over time as part of an adaptive management process as new information is gathered (see Section 9). The development of goals creates a mechanism for shared understanding of what habitat is important and how much is needed to achieve population goals.

Reporting on progress toward goals (generally on annual, biennial, or 5-year time horizons) is a critical adaptive management step to determine if recovery strategies should be re-evaluated and potentially revised (further described in Section 9). Reporting on progress toward habitat goals is not simply a summary of the progress made from acquisition and restoration projects, but also accounts for the net loss or gain of habitat across the landscape from land use activities. Reporting progress toward goals provides an assessment to determine if protective land use zoning, policies, and programs are adequately addressing the pressures identified in the next section of the plan (Section 4), and provide an effective tool for communicating gains and losses.

The following habitat types have been identified as important for steelhead in the East Kitsap DIP:

- Upland forest
- Freshwater wetlands
- Stream channel (including mainstem, associated floodplains, tributaries, and side channels)
- Riparian areas
- Lakes
- Nearshore habitat

This list of habitat types was generated by considering several existing local and regional habitat categorizations, the Common Framework for Chinook salmon, and determining the habitat types of most importance for steelhead. The intent is to focus on the habitat types that are specifically meaningful for setting goals and tracking progress towards steelhead recovery rather than being inclusive of the entire ecosystem.

Habitat goals were not developed for lakes due to a lack of data and an understanding that steelhead use these habitat types primarily as migration corridors to access other important spawning or rearing habitats; however, these are still important habitat types to consider in the recovery plan. Relevant strategies for ensuring functional migration corridors and foodwebs are described in Section 6. Only the priority habitat types that are critical for steelhead recovery and for which enough information is available to both develop goals and track progress toward meeting them are included here.

As part of the adaptive management process described in Section 9, additional goals or more quantitative goals can be developed and improved as the plan is implemented and data gaps are filled. Similarly, additional detail could be used, for example, to separately track habitat conditions inside and outside urban growth areas (UGAs). This is especially useful for goals like riparian cover where different land use policies may drive protection and restoration of the habitat type. While the goals are stated in specific geographic units (subwatershed or drainage) and the current status has been analyzed using those units, additional analysis by drainage or reach can provide more detailed information to better manage the plan and focus effort where it is most needed. The goals that follow are long-term, broad habitat goals that reflect a desired future state as described in the vision statement and help communicate direction and progress to a wide audience.

Habitat goals use the hierarchical management units – 7 subwatersheds and a tiering system - described above in Section 3.1. Because habitat types may be tracked and managed at different scales, identifying appropriate management units for each goal (e.g., subwatershed, Tier 1 drainages) is important. The order of the goals that follow is based on scale, starting with those at the subwatershed-scale and moving to drainage-scale.

3.3.1 Upland Forest

Long-term habitat goal statement:

By 2070, forest cover extent is increased to or exceeds 65% in all seven subwatersheds.

Specific goals:

Unit: Sub-watershed	Desired Outcome (increase or maintain)	2070 Goal	Current Status
Big Valley – Dogfish	↔	≥ current levels	69% 21,621 acres
Barker-Dyes	↑	65%	43% 8,402 acres
Blackjack	↑	65%	61% 12,369 acres
Curley – Colvos	↔	≥ current levels	68% 18,123 acres
Chico-Sinclair	↔	≥ current levels	75% 9,348 acres
Bainbridge Island	↔	≥ current levels	70% 7,022 acres
Vashon Island	↔	≥ current levels	73%*

The upland forest habitat type includes all mapped forest in the NOAA Coastal Change Analysis Program (C-CAP) forested category (deciduous, evergreen, mixed, and scrub/shrub cover classes). Current status was developed using the GIS database compiled by Nash (2017) for the East Kitsap Steelhead Habitat Evaluation Project, which combines all forested category types from the 2011 C-CAP timestamp and summarizes by subwatershed boundaries.

The goal of 65% or higher was selected based on a King County analysis of watershed function (Booth et al 2002).

**Vashon Island status is based on a land cover analysis from over 15 years ago (King County 2005) and may not follow the same methodology as other sub-watersheds. While this is not considered a data gap, additional work is needed to determine more recent status and provide total acreage.*

3.3.2 Freshwater Wetlands

Long-term habitat goal statement:

By 2070, freshwater wetland extent has increased beyond the current status in all seven subwatersheds.

Specific goals:

Unit: Sub-watershed	Desired Outcome (increase or maintain)	2070 Goal	Current Status
Big Valley – Dogfish	↑	> current levels	4.7% 1,477 acres
Barker-Dyes	↑	> current levels	3.9% 745 acres
Blackjack	↑	> current levels	4.2% 925 acres
Curley – Colvos Passage	↑	> current levels	5.2% 1,373 acres
Chico	↑	> current levels	5.7% 703 acres
Bainbridge Island	↑	> current levels	3.7% 372 acres
Vashon Island	N/A	N/A	N/A

The freshwater wetland habitat type includes off-channel and adjacent wetlands for both steelhead rearing and hydrologic functions. Current status was developed using the GIS database compiled by Nash (2017) for the East Kitsap Steelhead Habitat Evaluation Project, which uses local (Kitsap County) and federal (National Wetland Inventory) data layers and summarizes by subwatershed boundaries.

3.3.3 Riparian Areas

Long-term habitat goal statement:

By 2070, riparian cover in all steelhead streams has increased; priority is to increase in Tier 1 drainages, particularly where steelhead are known to spawn and rear.

Specific goals:

Unit: Drainage	Desired Outcome (increase or maintain)	2070 Goal	Current Status
Blackjack Creek	↑	> current levels	39% cover
Chico Creek	↑	> current levels	56% cover
Clear Creek	↑	> current levels	29% cover
Curley Creek	↑	> current levels	40% cover
Gorst Creek	↑	> current levels	69% cover
Grovers Creek	↑	> current levels	35% cover

The unit for riparian cover goals is the drainage rather than subwatershed in order to focus initially on steelhead extent and increase riparian function in the spawning and rearing locations; in addition, the current status listed includes only the Tier 1 drainages to focus on priority areas. Current status was developed using the NOAA C-CAP forested category data compiled by Nash (2017), as used above for Upland Forest, and calculating the amount of forest cover within 200 feet of the mapped stream.

3.3.4 Stream Channel: Accessibility (Longitudinal Connectivity)

Long-term habitat goal statements:

By 2030*, steelhead can access 100% of historically accessible habitat in all six of the Tier 1 drainages (Blackjack, Chico, Curley, Clear, Gorst, Grovers).

By 2070, steelhead can access 100% of historically accessible habitat throughout the East Kitsap DIP geography.

Current status was developed using the estimated historic steelhead habitat extent developed by the project team, which was a combination of the historic steelhead layer developed by the Puget Sound Steelhead Recovery Team and the current NWIFC steelhead distribution layer in GIS. Biologists with the Suquamish Tribe then reviewed and edited these layers, based on their local knowledge and best professional judgement on where steelhead were historically distributed. This process resulted in some additions to the extent of the preliminary GIS layers. In total, 233 km (144.8 miles) of historic steelhead habitat were identified in the whole of the East Kitsap DIP (Figure 2-3).

A quantitative analysis of current status of accessibility for each drainage is an information gap.

**Although this is a 50-year recovery plan, the accessibility/passage goal should be met within 10 years in the Tier 1 steelhead drainages. This aligns with the timing for all state-owned culvert improvements which must be completed by 2030.*

3.3.5 Stream Channel: Floodplain Function (Lateral Connectivity)

Long-term habitat goal statement:

By 2070, increase connectivity and floodplain function in all steelhead drainages.

A quantitative analysis of current floodplain connectivity and historical extent of floodplain habitat, and an associated goal to represent a desired future state for each of the primary steelhead drainages, remains an information gap.

3.4 Other Recovery Goals

The section above describes the long-term goals for extent and condition of freshwater habitat types; however, in order to reach recovery, other goals must be met or exceeded in addition to freshwater habitat. The goal statements that follow are broad and qualitative, but are intended to communicate the importance of water quantity and a functional marine foodweb as key elements to the recovery of East Kitsap steelhead.

3.4.1 Water Availability

Long-term goal statement:

By 2070, instream flows are sufficient and cool enough during summer low flow periods for all steelhead life stages to thrive in East Kitsap streams.

3.4.2 Marine Foodweb

Long-term goal statement:

By 2070, forage fish have increased access to spawning and rearing habitat in East Kitsap and have robust populations throughout Puget Sound in balance with pinniped populations, so that sufficient numbers of steelhead smolts survive the migration through Puget Sound.

4 PRIORITY PRESSURES

4.1 Overview and Approach

The pressures assessment for the East Kitsap Steelhead DIP was conducted by gathering available information about relevant regional pressures from existing plans, vetting the list with the Suquamish Tribe, and reviewing and rating the pressures with the WSPER Salmon Technical Advisory Group and other stakeholders through a series of meetings. The assessment approach was focused on steelhead life-history stages, providing a means to consider habitats used by steelhead based on the timing and duration of each life stage in these habitats and distinguishing where pressures have impacts on different stages. Employing a life-cycle approach is consistent with the WDFW approach to life-cycle modeling and monitors species by life stage. Because recovery potential is more limited for certain life stages, this approach allows for analysis on those stages and building a recovery plan around the highest priority pressures that impact them. The life history stages analyzed included: adult spawning; egg incubation and emergence; juvenile rearing; smolts/early marine; maturation/open ocean; and adults migrating, holding, and kelts.

The list of pressures and stressors follows those in the Regional Plan. The list of pressures relevant tor East Kitsap steelhead was further expanded to additional pressures that impact steelhead in East Kitsap, such as military installations and non-native fish. These pressures have been identified in other local planning efforts, like the LIO Ecosystem Recovery plan.

Figure 4-1. Relationship of Pressures and Stressors impacting steelhead in East Kitsap (modified from the Puget Sound regional steelhead recovery plan, NMFS 2019)

Figure 4-1 shows the relationship of pressures and stressors in the East Kitsap DIP geography as they relate to steelhead. The graphic is a modified version of a similar graphic from the Regional Plan. This includes pressures specific to the East Kitsap DIP, not included in the Regional Plan. Harvest, which includes poaching and ocean harvest, is not connected to a stressor because it acts directly on steelhead.

Climate change is not included in the graphic because it is considered an overall contributing factor that increases the severity and extent of several pressures and stressors through a variety of pathways and mechanisms that are further described in the pressure descriptions in Section 4.2.

The pressures assessment rates the scope, severity, and permanence/irreversibility of each pressure by life stage. The Miradi database uses algorithms to then develop a summary rating. The algorithms have been developed and refined over time by Open Standards users as described on their website (https://www.miradi.org/faqs/). Each rating was discussed with a core group from the Tribe and the WSPER Technical Advisory Group (TAG) who referenced maps, reports, and citations as they considered the ratings; these overall ratings were then vetted through a WebEx workshop open to the entire TAG for refinement, and finally presented with relative ratings ranging from high to low of the priority list of pressures affecting steelhead. This summary provides a basis for the development of strategies to address the pressures through prevention, mitigation, removal, or restoration (as described in Section 5). While technically grounded, the assessment is not meant to be overly precise; rather, all of the pressure ratings are addressed in the plan with relative ratings of importance, assumptions, and subjectivity of some considerations. These ratings can be revised through adaptive management as information gaps are filled or as new pressures arise. Assumptions, evidence, data gaps, and the participants are all documented in an East Kitsap Pressures Miradi file available in the Puget Sound Partnership's MiradiShare website. An export file from the Miradi database with additional detail on the ratings by life stage and associated notes is available in Appendix B.

Scope is the geographic or spatial extent of the pressure in the East Kitsap DIP. A 20-year horizon was used to consider scope given assumed continuation of current circumstances and trends.

Severity is the level of damage expected within the given/ predicted scope.

Permanence or irreversibility is the degree to which the effects of the pressure can be reversed with intervention. Irreversibility considers feasibility and length of recovery in the ratings, which can be subjective.

Figure 4-2 provides summary ratings of each pressure (organized alphabetically) by life stage, showing scope, severity, irreversibility and a summary rating. Blank ratings indicate no relationship between the pressure and life stage. The pressure assessment is further described in each sub-section below.

Figure 4-2. Summary Pressure Ratings by Life Stage

4.2 Pressures in the East Kitsap DIP

The process described above resulted in the identification and rating of pressures, which affect steelhead life history stages to varying degrees. The following subsections describe the priority pressures for steelhead, where they occur most in the East Kitsap DIP, and how they affect specific steelhead life-history stages. Differences were noted in how NMFS defined a pressure in the Regional Plan and how the pressure was defined locally in East Kitsap (e.g., see dams). Pressures that were not included in the Regional Plan but are identified in East Kitsap are described below and include military installations, mining, invasive species and commercial aquaculture. Climate change and population growth are predicted to exacerbate some pressures and stressors which are highlighted in call-out boxes. Climate change is further described in Section 4.2.15.

4.2.1 Roads and Culverts

Roads and culverts impact steelhead in a variety of ways. Impassable culverts reduce habitat carrying capacity by blocking access to habitat, and limiting abundance and spatial structure (NMFS 2018). For steelhead, repeat spawning adds to the productivity of a population and can only occur if adult fish can move downstream to the marine environment and return again to the freshwater system to spawn, making passage a very high priority for this species. Because steelhead occupy smaller tributaries and a larger geography than other listed species like Puget Sound Chinook, passage barriers may pose a greater threat for this species. Impassable culverts also reduce access to juvenile steelhead refugia habitat in tributaries during floods. Furthermore, undersized or blocking culverts can prevent or restrict the transport of sediment and wood downstream as part of natural channel processes that promote complex and diverse habitats for steelhead. Roads can be a source of sediment and non-point pollution from run-off and from vehicles using the roads. Roads are also associated with armoring along both freshwater and marine shorelines, and they can restrict channel migration and impair riparian function along streams.

With much of the East Kitsap DIP zoned for development (i.e., relatively few naturally protected lands), roads and culverts will likely be a continuing pressure in the future. Unlike other DIPs that include high elevation areas in the geography (e.g., Hood Canal or eastern Puget Sound), there are very few parts of East Kitsap that are protected topographically from roads.

Roads and culverts lead to the following stressors: freshwater shoreline hardening, riparian alteration, non-point source pollution, altered temperatures, in-stream impacts (such as changes in bed materials, scour, etc.), sediment, and barriers (see Fig 4-1). These act directly on key freshwater life stages (including juvenile rearing) as barriers, while also degrading foodweb function and habitat complexity.

Scope: High
Severity: High for all freshwater life stages
Permanence: High

Permanence is high because while there is immediate benefit from culvert replacement, there is a constant threat of new roads and culverts, so placement and protection may be important elements (see strategies). Roads once built are difficult, but not impossible, to remove and abandon in this geography. Even when passage is corrected, there are still impacts from the road itself – run-off, loss of cover, and increased sediment.

This pressure is critical for juvenile rearing, blocking access to tributaries and off-channel areas in winter flood events as well as to cool water refuge in summer. Reducing overall capacity and habitat availability may increase competition for resources. This pressure is rated as high severity for all freshwater life stages. Even the out-migrating smolt (early marine) life stage is considered impacted as roads disrupt nearshore habitat directly by filling intertidal areas or disrupting sediment delivery and transport processes, which have marine foodweb implications.

This pressure will increase with population increase in the DIP.

4.2.2 Dams (man-made)

Scope: Low to Medium
Severity: Low to High
Permanence: Medium

The Regional Plan (NMFS 2018) considers large hydropower and water storage/diversion facilities, which are not present in the East Kitsap DIP. However, several small mad-made dams are identified as fish passage barriers, many or all of which are privately owned. This pressure also includes fishways (weirs and ladders) and structures at the outlets of local lakes that alter flows and passage. These structures are largely concerns for fish passage, and thus a higher priority for juvenile rearing and migrating adults – particularly kelts as they attempt to move back downstream. These smaller dams have some sediment concerns but not to the extent that larger dams do. In terms of scope, dams are limited in the DIP. Small dams exist on Blackjack Creek, Strawberry Creek, and Gorst Creek (just downstream of the hatchery) and possibly other systems. Because some dams have passage ladders, their impact on steelhead should be considered on a case-by-case basis. Where dams are a passage concern, once they are fixed or removed, the problem is easily reversed, similar to culverts; however, the threat of construction of more small dams, particularly on private land, is an ongoing concern.

This pressure may increase with climate change in the DIP as increased summer low flows leads to the desire for water retention on private or public property.

4.2.3 Flood Control

Scope: Medium
Severity: Low to High
Permanence: Medium

While the topic of floodplain impairment is defined in the Regional Plan largely as an issue for large watersheds with significant floodplains and deltas, this pressure exists on a smaller scale in the East Kitsap DIP through flood control infrastructure and localized but widespread actions. Dikes and bank armoring along streams cause isolated and straightened channels that reduce habitat complexity. Small dikes and armoring are an issue in agricultural areas of this DIP (legacy impacts of draining and ditching is dealt with in *Agriculture,* below), and continued emergency and maintenance dredging to convey water is a primary impact to streams. This pressure leads to freshwater shoreline hardening, riparian alteration, and altered flows. The impact of dredging and the resulting lack of habitat complexity affects all freshwater life stages; however, the act of dredging, particularly emergency and unpermitted dredging, is more of a threat to egg incubation/emergence and juvenile life stages than to adult life stages. The scope of this pressure is medium across the East Kitsap DIP based on WDFW permit requests and known unpermitted dredging observed by

This pressure is likely to increase with climate change; particularly as more intense storms cause damage or additional conveyance is required in winter months.

WDFW and the Suquamish Tribe; however, this occurs largely in smaller channels, not major streams. The reversibility is rated as medium because the effects are reversible and a cultural shift is possible to reduce or eliminate illegal dredging. Note that even permitted dredging may be impacting steelhead because the timing allows for dredging in summer months to better protect species other than steelhead (i.e., to protect fall/early winter spawning fish and incubating eggs). Determining the amount and location of permits and patterns of illegal activity would help address this pressure.

4.2.4 Agriculture

Scope: High
Severity: High for most freshwater life stages
Permanence: Medium

While recognized as a type of open space and beneficial to the rural character of the East Kitsap DIP, the legacy of agricultural practices has altered the landscape through forest conversion, ditching and channeling streams and wetlands, and installing small dikes and dams within floodplains. Current practices continue to affect water quality through nutrient loading from livestock and fertilizer run-off, additional pollution through pesticide use, and degradation of riparian areas. While protecting farmland may be an important part of the solution to stemming impacts from urbanization described in other parts of this section, the stressors associated with agriculture that degrade habitat and water quality create their own impacts. Stressors from agriculture that affect steelhead include freshwater shoreline hardening, riparian alteration, non-point source pollution, altered flows, sediment, altered temperatures, and low dissolved oxygen. The legacy impacts and current agricultural practices that degrade both habitat and water quality must be addressed as an important part of steelhead recovery. Associated dams, dikes, bank armoring, and dredging are addressed in other pressures in this section.

The East Kitsap DIP lacks the large tracts of agriculture that exist in river deltas or agricultural production zones in other Puget Sound watersheds. This means there are fewer large parcels to protect and conserve as farmland; however, the agricultural footprint is significant in the DIP, and where practices affect riparian, floodplain, hydrology, and water quality, they have impacts on steelhead habitat. The current agricultural footprint is found in several of the subwatersheds of East Kitsap, but legacy agriculture (draining and ditching of wetlands, conversion, etc.) is present throughout the DIP.

A major local challenge is that current incentive structures favor development rather than the restoration of ecological functions on agricultural lands. This shifts agriculturally productive lands to smaller-scale rural-residential and hobby farm lots, making it more challenging to protect or restore wetlands, riparian vegetation, floodplain, and channels.

The major impacts are to egg incubation/emergence, and rearing juveniles (through altered sediment, hydrology, and higher temperatures). Because migrating adults can move to less-impacted sites, that life stage is rated lower, but they are still forced to shift which can lower productivity; however, agriculture can greatly affect where adults can move, hold, and spawn (primarily because of excessive fine sediment). To reduce impacts, it is possible to develop best practices for water quality, riparian habitat, and to restore areas, but these take time. Altered hydrology is a larger concern, but it is more feasible to reverse pressures from agriculture on the landscape than developed/paved areas.

While the pressures of both agriculture and timber harvest may be reduced with increased population (see *Development*), the associated stressors may increase with climate change as summer low flows decrease and streams with lack of riparian cover heat up more quickly.

4.2.5 Timber Harvest

Legacy timber harvest in Puget Sound has created a network of sediment-delivery systems through roads, slope failures, and logging on steep slopes and in riparian areas, all of which have affected steelhead and their habitat (NMFS 2018). Old-growth forests have largely been replaced by tree farms and second- or third-growth forests. Timber management can degrade habitat by reducing recruitment of instream features like large wood, reducing shade by harvesting riparian trees, altering hydrology affecting both high and low flows, and road construction that introduces barriers and delivers sediment.

Unlike residential, commercial, and industrial development that hardens the landscape, timber harvest can be managed to improve or continue ecosystem services such as carbon sequestration, aquifer recharge, temperature moderation, and other benefits of upland and riparian forest cover. Forest practices, enforcement, and monitoring differ depending largely on who manages the land. In the East Kitsap DIP, there is a mix of private and state owned or managed forests. Unlike other watersheds in Puget Sound, there are no U.S. Forest Service owned parcels in East Kitsap.

Very few locations in the East Kitsap DIP were spared from logging and currently support late-successional forest. This results in legacy impacts as well as impacts from current harvest (e.g., a rare remaining stand of late successional forest was harvested since 2015 in the Blackjack subwatershed). The East Kitsap DIP lacks the topographic or legal protections of forests found in the Olympics or the Cascades, which have larger tracts of forested land with few landowners and areas that are less likely to be converted to development.

Scope: Very High
Severity: Medium to High
Permanence: High

The stressors that result from legacy logging include sediment from logging roads, altered hydrology from a lack of mature forests in the uplands, and lack of shade in the riparian zones, which disproportionately affect eggs, emerging fry, and rearing juveniles. Current timber harvest practices are generally more protective than many decades ago, and if implemented and enforced according to regulations they can help mitigate or reduce stressors through best management practices (BMPs), improved rotation schedules, leaving riparian areas intact, and managing for ecosystem services like carbon sequestration; however, logged sites still result in changes to hydrology, sediment, and invasive species. Similar to agriculture, the threat from timber harvest may be reduced but shifted to other pressures as timber companies sell to developers or mining companies. The ability to reverse or restore impacts from timber harvest is generally more feasible than pressures from development and its associated increase in impervious surfaces.

4.2.6 Residential, Commercial, and Industrial Development

As the number of people on the landscape has increased, particularly in central Puget Sound, so have demands on natural resources, including space and increased water use for development. As urban areas become denser, more people seeking either space or lower costs are pushed into previously undeveloped or less-developed areas, such as the East Kitsap DIP. Data from 2017 for all of Kitsap County (which includes most of the East Kitsap DIP area) show 60% of the human population within designated urban growth areas (UGAs), while 79% of the employment occurs within UGAs (Puget Sound Regional Council, WA Office of Financial Management). The target is to have 76% of the population within UGAs and 24% outside of UGAs (Kitsap County Coordinating Council, undated). With the continued boom of population and transportation systems, increased development in the East Kitsap DIP is very likely. The new high-speed passenger ferry operated by Kitsap Transit between Seattle and Bremerton and Seattle and Kingston provides a faster commute for people who work in or near Seattle, and therefore may promote greater population growth in East Kitsap.

Development pressure is substantial in the East Kitsap DIP. In a report to the legislature by the University of Washington College of Forest Resources (2009), Kitsap County ranked very high for risk of private forestland conversion from development, especially in the northern and eastern parts of the peninsula. The report states that once such lands are converted, they would no longer qualify for coverage under the Habitat Conservation Plan (College of Forest Resources 2009). In most subwatersheds of East Kitsap, the urban growth areas (UGAs) are lower in the watershed in areas through which all steelhead from that stream must migrate. While it would be ideal for all development to be relegated to the UGAs, nearly all privately owned land in the DIP is currently zoned for potential development, and the largest required parcel size is 20-acres. Development is expanding throughout the DIP as forest and agricultural land shifts to rural-residential and smaller lots. On Vashon Island, in King County, the lowest density zoning is 1 development unit per 10 acres.

Scope: Very High
Severity: High for all life stages
Permanence: High

Increased urbanization from residential, commercial, and industrial development has several related impacts on the ecosystem, some of which are described above (such as culverts and conversion of riparian habitat), and that affect all steelhead life stages. In addition to the direct conversion of habitat, the signature issue of development is an increase in impervious surfaces – roads, parking lots, rooftops – that shift and degrade the hydrology of a watershed. Reduced aquifer recharge, along with other stressors (see *Water Withdrawals* and *Climate Change)*, results in lower flows in summer months. The expedited delivery of water directly to streams through surface flow also results in poor water quality. Pollutants that may have otherwise been filtered through soil or vegetation are delivered directly to streams that provide steelhead habitat. Since steelhead spend more time rearing in freshwater than other listed salmonids in Puget Sound and the East Kitsap DIP, this produces far-reaching effects for early life stages. Development increases non-point source pollution from stormwater flow on roads, yards, parking lots, and industrial lots. Point source pollution, while more regulated, is a continued consequence of development through new and emerging contaminants of concern such as household and industrial wastewater. In at least one watershed in Puget Sound (Nisqually), an increase in PBDEs (flame retardants) is resulting in lower survival rates of steelhead smolts in the marine environment during outmigration (Schmidt & O'Neil 2018). Increased haul-outs for pinnipeds and nearshore infrastructure may be changing the marine foodweb and increasing smolt mortality in the region, and perhaps locally as well.

4.2.7 Water Withdrawals and Altered Flows

Scope: Very High
Severity: High to Low
Permanence: High

The East Kitsap DIP is a low-elevation, rain-dominated part of Puget Sound; without snowpack or glaciers, the area relies heavily on wetlands, forest cover, floodplain function, and groundwater aquifers to provide adequate water flow throughout the year. Steelhead require adequate stream flows to meet their requirements during freshwater life stages. Stream flows have likely decreased over time in many subwatersheds because of the high demand for water from residential, commercial, and industrial development; timber harvest; agricultural uses; and climate change effects. Water withdrawals and flow modifications occur through several activities.

Climate change and impervious surfaces when combined with water withdrawals will compound alterations to the hydrologic function of watersheds, increasing high flows during storm events and reducing base flows during dry periods. These pressures collectively change the availability, timing, and quality of water available to steelhead. The location of water withdrawals and the loss of forest cover (as described in *Timber Harvest* and *Development*, see above) can vary the impacts on flow. For example, deforesting or diverting water from aquifer recharge areas can produce a larger negative effect on available water to downstream habitats than similar actions in other parts of the watershed.

The removal of beavers and deforestation, hardening of shorelines, and other human-induced pressures have changed the hydrology of subwatersheds. Steelhead rely on these systems for hydrologic function including connected floodplains, wetlands, and off-channel habitats. Reduced low flows can also result in increased temperatures, which may increase the susceptibility of incubating eggs, recently emerged alevins, and juveniles to both disease and predation (NMFS 2018).

Climate change will increase this pressure in the DIP

Water withdrawals for development and out of basin water transfers can reduce groundwater levels and instream flows available for steelhead. Development pressure and rural residential zoning allows for permit-exempt wells. Future Public Utility District (PUD) service could reduce the number of wells, but this would also require the utility to secure more water rights. The scope of this pressure covers the entire East Kitsap DIP. For the egg incubation life stage, the current threat is not severe; since steelhead are not incubating when streams typically run dry. However, the future threat could be severe if water withdrawals and/or climate change shifts the timing of stream flows and water temperatures warm earlier in late spring and summer. For the juvenile rearing life stage, this is currently a highly rated pressure; juveniles that rear in streams throughout the summer must seek alternative locations as some streams run dry. Localized climate impacts of higher air temperatures may be locally buffered by groundwater connections that deliver cool water to streams in this DIP throughout much of the year. However, recent data indicates that there are limits to this buffering effect as air temperatures warm in summer (Suquamish Tribe 2016). If groundwater is diverted or disconnected, the combination of a lack of flow and lack of cold water delivery/refugia will cause significant problems for juvenile steelhead.

4.2.8 Hatcheries

Scope: Low
Severity: Low
Permanence: Low

There are no existing or planned steelhead hatcheries in the East Kitsap DIP. Therefore, the issues addressed in the Regional Plan from potential genetic introgression and competition for resources from hatchery steelhead in the watershed are not locally relevant. However, the timing, stray rates, and impacts of other hatcheries – be they steelhead hatcheries in other watersheds or other species produced locally – should be considered in the context of overall steelhead recovery. Non-native rainbow plant outplants are addressed in a separate pressure (see 4.2.12). In the marine survival portion of the Regional Plan, there is interest in analyzing and testing the impacts of hatcheries on early marine survival of steelhead. It is possible that the timing of hatchery releases of Chinook and coho salmon helps steelhead by providing buffer prey, or the presence of hatchery fish may attract predators and increase mortality of outmigrating steelhead smolts. Additional study is needed to better understand these potential ecological and genetic effects.

Pressures from hatcheries are not likely to change with climate change or increased population in the DIP.

The infrastructure of some older coho hatcheries in the East Kitsap DIP may cause fish passage and sediment concerns, particularly in Gorst Creek as mentioned in the dam section above.

4.2.9 Harvest

Scope: Low
Severity: High (for adults) to Low
Permanence: Low

While legacy impacts from extensive harvest are one reason for the long-term decline of Puget Sound steelhead, the Regional Plan does not cite overharvest as a primary factor currently limiting viability. There are no existing commercial, recreational, or tribal steelhead fisheries in the East Kitsap DIP, and steelhead numbers are so low that poaching (as occurs in in other regions, such as the Washington Coast) is currently unlikely. Directed fisheries on coho, Chinook and chum salmon in the DIP are unlikely to intercept steelhead now. Harvest management plans, developed by co-managers and approved by NOAA Fisheries, have incidental take exemptions for ESA species, including steelhead. Harvest of kelts can constrain the proportion of repeat spawners in a system, thereby reducing productivity, which must reach increased levels for recovery. As steelhead numbers increase, any poaching of adults (migrating, holding, and including kelts) will have a disproportionate impact on these small populations and should be closely monitored. Incidental catch by freshwater recreational fishers is a potential threat from mortality in catch and release fisheries and if steelhead are inadvertently mistaken for other species, notably non-native rainbow trout outplants. This is a particular risk where "put and take" fisheries occur (e.g., Wildcat, Kitsap, and Long lakes). Through education and enforcement, however, both issues should be reversible.

4.2.10 Predation

In the Regional Plan, predation is largely a proxy for early marine mortality and represents multiple pressures and stressors that directly and indirectly limit survival in Puget Sound. Mortality of smolts during outmigration in the lower rivers, estuaries, and in Puget Sound is a key limiting factor for steelhead as well as Chinook salmon and coho salmon. The high mortality rates for steelhead smolts migrating through Puget Sound toward the ocean are a key limiting factor for the productivity and abundance of steelhead in the region. The phenomenon is also being observed and researched for coho and Chinook, but because steelhead have a shorter migration window, the findings and strategies to address the issue are unique. This issue is important for the overall recovery of the Puget Sound steelhead DPS and is described in detail in Appendix 3 of the Regional Plan. The findings focus on predator-prey interactions and poor fish condition/altered behavior. The factors that contribute to predator-prey interactions include direct predation, notably by harbor seals; lack of buffer prey (forage fish); human infrastructure (largely pinniped haul-outs in the marine environment or other structures that aggregate fish, such as a dam); and the pulse abundance of hatchery fish (described above). The factors that contribute to poor condition or altered behavior include disease (notably *Nanophyetes salminicola*), contaminants (notably flame retardants), and genetic fitness. The findings also indicate that fish disease and contaminants are currently watershed and site-specific (Schmidt & O'Neil 2018). While these factors (i.e., disease, contaminants, and genetic fitness) should be monitored in the East Kitsap DIP, there is no indication that they are currently contributing to high mortality rates.

Because this is a regional issue and one to be addressed at a larger scale (e.g., MPG), the pressures should be assessed primarily through regional approaches. However, the localized impacts of increased predation associated with marine infrastructure are important to address at the local level. Human infrastructure in the form of docks, piers, breakwaters, buoys and other overwater structures may attract pinnipeds to the vicinity of outmigrating smolts. Recent pinniped surveys by WDFW observed large numbers of harbor seals and in some cases California sea lions can haul out on many artificial structures (associated with marinas, floats, Naval floating security fencing) within several relatively narrow waterways in East Kitsap marine areas (Jeffries et al. 2020). While steelhead are not known to directly use Puget Sound nearshore habitat during their outmigration life stage, bulkheads and other marine shoreline armoring is a concern by destroying or reducing forage fish spawning and rearing habitat. The abundance of forage fish populations may indirectly affect steelhead survival. When there is a lack of forage fish, there may be an increase in steelhead predation by pinnipeds and other predators. If other prey is abundant (i.e., forage fish), outmigrating steelhead smolts may be buffered from predation, hence the term “buffer prey”. This is why pressures that are largely in the nearshore (such as *military installations*) rate as important for the smolt life stage.

A major knowledge gap for this DIP and in Puget Sound generally is pinniped predation on returning adults. With small populations in the streams draining into Puget Sound in East Kitsap in an area with numerous natural and artificial seal haul-outs, predation on adults could likely have a significant impact on the ability of these populations to rebound if returning adults cannot get past the river mouths and into freshwater habitat; this would also be a major issue for the kelts in the East Kitsap DIP. More research is needed before strategies can be developed and tested.

4.2.11 Military Installations and Railroads

Scope: Low to Medium
Severity: Low to High
Permanence: High

Military installations are addressed separately from industrial development because the causal agent and management strategies (addressed via the Integrated Natural Resources Management Plan for Naval Base Kitsap) differ. Compared to other DIPs, military installations are extensive in the East Kitsap DIP (Bremerton, Keyport, Manchester, and water quality impacts from Bangor); however, their locations do not affect many freshwater life stages. This pressure results in the following stressors to steelhead: point source pollution, non-point source pollution, passage barriers, noise/vibrations, overwater structures, and marine shoreline infrastructure that act as pinniped haul-outs and destroy or damage forage fish habitat. These are both legacy and current impacts. While some may be mitigated or managed for with the Department of Defense (DoD), different regulations often apply for development on these lands, and the permanence of this pressure is high.

Neither military installations nor railroads are likely to change with increased population or climate change.

Scope: Low
Severity: Medium to High
Permanence: Medium

Military railroads are addressed with military installations because the only railroads in the East Kitsap DIP are owned and managed by the DoD. In the Regional Plan, railroads are combined with roads as a pressure, with a focus on culverts. The military railroad is minor in scope but crosses several watersheds, notably Chico and Gorst. Fish passage and sediment are the most relevant stressors for both adult and juvenile steelhead rearing in freshwater, but may also affect outmigrating smolts in the nearshore by eliminating forage fish spawning habitat where the railroad runs along the north shore of Sinclair Inlet to the Bremerton Naval Shipyard.

4.2.12 Non-native Species (Fish and Plants)

Scope: High
Severity: High to Very High
Permanence: Medium

The extensive lakes and ponds of the East Kitsap DIP provide habitat for non-native fish, both the stocking of rainbow trout by WDFW and from the release of warm water fish by residents. This pressure results in predation, mortality from catch and release fisheries, competition directly affecting adult and juvenile steelhead, and genetic introgression from hybridization. Some of the most important areas in the system for steelhead recovery (e.g., Chico and Curley creeks) have WDFW-stocked lakes with hybridization documented at least within the Chico watershed. The scope is high because of the location of large lakes and the extent of artificial ponds in the East Kitsap DIP. Once systems are stocked, it is difficult to reverse and likely requires constant management.

Scope: High
Severity: Medium
Permanence: Medium

Invasive plant species are also prevalent throughout the East Kitsap DIP. Areas with current and historic conversion for timber harvest and agriculture are susceptible to non-native and invasive plant species. Nightshade, knotweed and other species directly affect steelhead by acting as a passage barrier in certain systems, while species such as reed canarygrass can reduce dissolved oxygen in streams and wetlands. Ivy and other invasive species destroy trees and overtake riparian areas, threatening both shade and habitat complexity in the creek. While possible to reverse, it is expensive and requires constant management to ensure that the pressure does not recur.

Both non-native fish and invasive plants will likely increase under climate change and population growth.

4.2.13 Mining

Scope: Low to Medium
Severity: Medium
Permanence: High

Mining is a locally specific threat, particularly gravel and basalt mining in the East Kitsap DIP. It was not addressed in the Puget Sound Steelhead Recovery Plan; however, potential impacts on aquatic resources include increased sediment, altered flows, altered temperatures, and noise/vibrations. The location, compliance with regulations, and revegetation/reclamation procedures determine how much of a threat an individual mine is to steelhead. Existing mines in the East Kitsap DIP are not near steelhead streams, but upland impacts and the threat of future mines permitted near streams are a concern. This pressure was rated based on the 10- to 20-year threat of additional mines as timber companies sell property. The severity for all life stages is medium, but the concern is that the permanence is high; it is easier to prevent future mines from affecting steelhead rather than restoring or mitigating an existing mine.

4.2.14 Commercial Aquaculture

Scope: High
Severity: High for migrating juveniles and adults
Permanence: Low

Atlantic salmon and, potentially in the future, steelhead raised in commercial net pens in the marine waters of the East Kitsap DIP are a threat to native steelhead. Their location in Rich Passage is in a marine migratory corridor, resulting in steelhead from this and other DIPs being potentially affected at the early marine outmigrant and adult life stages. Depending on the species, net pens may attract predators, provide haul-out locations, amplify parasites and viruses, escape and hybridize with native species or result in the bycatch of adults or juveniles when the nets are harvested. This is largely a data gap as a known impact on steelhead.

Commercial shellfish beds may affect steelhead indirectly through the impairment of forage fish habitat. The footprint of shellfish beds in the East Kitsap DIP is relatively minor. The associated infrastructure of shellfish farming (plastic tubes, nets) may be a concern for forage fish; the location low in the intertidal would not result in impacts on beach-spawning forage fish, but would potentially affect herring. Sediment, boat scour, and hydraulic pumping from rafts/floats may impact eelgrass beds through shading, added nutrients and direct conversion.

Commercial net pens and commercial shellfish beds were rated separately in the process with details in Appendix B, but combined here for simplicity.

4.2.15 Climate Change

Climate change was considered and rated separately from the above pressures because it is a contributing factor that acts through other existing pressures or stressors. The rating shown in Appendix B are varied, but the Tribe and consultant team determined that more important than the rating itself is considering how climate acts through existing pressures and how it can be addressed in a steelhead recovery plan. The approach to addressing climate change in this plan is through impacts that will likely change the structure, extent, or function of habitat or directly affect steelhead. Increased emissions from humans are the cause of climate change, but addressing emissions through mitigation strategies is beyond the scope of this plan. Future work by Kitsap County, Suquamish Tribe, and other jurisdictions may address specific greenhouse gas reduction targets and plans. The climate impacts identified in the Regional Plan (2019) that will affect steelhead and their habitat include increased high flows with more intense winter storms, lower summer low flows, and higher air and stream temperatures in summer.

- **Increased high flows associated with increased storms**: This issue is primarily due to bigger storms and atmospheric rivers, rather than rain-on-snow events experienced by other basins in Puget Sound. During storm events, redds may be scoured depending on timing, overwinter survival rates may be reduced, sediment transport and deposition may increase impacting habitat structure and function, and increased velocity may form passage barriers that would not be as severe under normal flow conditions.
- **Decreased low flows in summer**: This issue may be less of a concern in East Kitsap, which does not rely on snowpack or glaciers for summer flows; however, a change in the overall hydrology could affect the groundwater and surface water flows on which steelhead depend. Lack of water in stream reaches during the summer and early fall may prevent connection to refuge habitat and/or strand rearing juveniles.

- **Higher temperatures**: Cold groundwater and hyporheic flow help buffer streams in East Kitsap from hot temperatures in the summer. However, temperature data collected by the Suquamish Tribe show that local streams are warmer during warmer summers, suggesting that the groundwater buffering has limitations (Suquamish Tribe 2016). If droughts become severe or groundwater connections are lost, resulting warm water can affect egg and juvenile survival. Rearing juveniles may be more susceptible to disease in warm water, and invasive species may compete or predate upon steelhead.

All impacts described above result in less available suitable habitat for steelhead in freshwater systems; additional potential impacts on steelhead, such as warming surface temperatures in the Pacific, changes in the marine foodweb, and ocean acidification articulated in the Tribe's State of Our Watersheds Report (NWIFC 2016), are not considered in this pressures assessment.

Coastal squeeze from sea level rise, particularly where shorelines have been armored, is likely to reduce the amount of intertidal habitat available for forage fish spawning (Krueger et al. 2009). As described in previous sections of the plan, reduced forage fish populations are hypothesized to impact steelhead juveniles as they outmigrate due to increased predation in Puget Sound when other prey is not available to these predators.

Some pressures identified and rated for steelhead will be worse in terms of the extent or severity as a result of climate change. Those are highlighted in call-out boxes above. Some development pressures (such as shoreline armoring) may worsen, not only with development but with climate change as homeowners see a hardened shoreline as a strategy to reduce impacts like erosion and sea level rise. The strategies and actions described in Section 5 provide a framework to address the most critical pressures for steelhead. The overarching approach for addressing climate change for the East Kitsap DIP is to identify and implement more strategies and actions that adapt to climate change and address the pressures and stressors exacerbated by climate change which are addressed in the next section.

5 RECOVERY STRATEGIES AND SUB-STRATEGIES

This section describes the overall approach to reduce historic and current pressures and achieve the recovery goals for the East Kitsap DIP. The relationship to the Regional Plan is articulated along with the most locally relevant strategies to achieve the recovery goals (habitat and fish population goals) established for this DIP (Section 3). Each strategy includes a description of the rationale, its relationship to the priority pressures and recovery goals, as well as the relevant steelhead life-history stages that would benefit through implementing the strategy. While all or most strategies would be beneficial to implement throughout East Kitsap, the geographic focus areas within the East Kitsap DIP identify where the strategy should be focused first to expedite steelhead recovery. The sub-strategies under each strategy represent a more specific suite of activities necessary to implement the strategy in the East Kitsap DIP. Specific projects, particularly those related to acquisition and restoration actions, are detailed in Appendix C and referenced below.

5.1 Puget Sound Steelhead DPS Strategies

The goal of the Regional Plan (NMFS 2019) is to improve the viability of natural-origin populations of Puget Sound steelhead so that the species is self-sustaining in the natural environment and the populations are sufficiently abundant, productive, and diverse, and thus no longer need ESA protection. Strategies and sub-strategies provided in the plan span from the DPS to the DIP-scale. The Regional Plan summarizes the basic recovery strategy for the South and Central MPG as follows: "(A)im to protect and increase access to high quality habitats, especially in upper watersheds, restore lower and middle watershed reaches with potential quality habitat, and improve juvenile survival in Puget Sound waters". The Regional Plan goes on to describe how to implement the overall strategy for the MPG in a series of bullets.

The regional strategies were a foundational element for creating the DIP-specific strategies below. In some cases, the regional strategies could be made more specific and locally relevant. In other cases, the strategy is best executed at the MPG or DPS level. The successful recovery of the East Kitsap DIP relies on local strategies identified below and assumes that the strategies identified in the NMFS Regional Plan will be funded and implemented. Without implementation at multiple scales, steelhead will not be considered viable at the DIP, MPG or DPS scales.

5.2 East Kitsap DIP Strategies

In the East Kitsap DIP Recovery Plan, strategies and sub-strategies span the subwatershed to drainage scale, while nesting within the overall Regional Plan. Many of the strategies and sub-strategies described in this section are common among multiple subwatersheds in East Kitsap and focus on freshwater productivity. However, the recovery of the DIP depends largely on the regional and MPG-level work. To recover steelhead in East Kitsap, recovery strategies must span multiple spatial scales, accommodate regional and watershed protection and restoration activities, include both voluntary and regulatory elements, and directly address the listing factors identified by NMFS.

The previous section identified the primary pressures limiting steelhead and their relative ratings. Several pressures interact or affect steelhead through the same stressors, such as passage barriers, increased sedimentation, or marine mortality. The list of strategies below reflects that some protection and restoration actions address a suite of pressures. The following guidelines were used when building the list of strategies and sub-strategies:

- Where applicable, use the regional strategies from the Regional Plan.
- Use existing watershed assessment plans to the extent relevant for steelhead.
- Use relevant strategies and sub-strategies from other local plans and efforts, such as the Chinook Monitoring and Adaptive Management Process (PSRITT 2015) and the West Sound Nearshore Integration and Synthesis of Chinook priorities (which account for forage fish use as well).
- Avoid redundancy and provide clear guidance on the actions needed to reach population and habitat goals in the East Kitsap DIP so that the plan is actionable.

Based on the latest understanding of steelhead biology, habitat use, and the current and future threats to those habitats (all described in previous sections), the strategies that follow attempt to address the pressures so that habitat extent and conditions improve and the steelhead population increases. The following principles were applied by the Suquamish Tribe and guide the strategies that follow:

1. Protect the best (most intact) habitat;
2. Manage for hydrologic maturity in forestlands;
3. Restore access and connectivity to freshwater habitats, both longitudinal (passage) and lateral (floodplains and wetlands);
4. Restore and protect habitat with a focus on larger parcels (often former agricultural lands) that are vulnerable to being converted to residential and commercial development;
5. Ensure adequate flows critical to steelhead freshwater life histories.

The strategies in this section reflect these principles and the prioritization framework of freshwater strategies developed for the subwatershed assessment plans (Chico-Frontal Sinclair, Blackjack, Curley-Colvos, Bainbridge Island). First order strategies are to protect and maintain function and process and reconnect or reestablish process. The second order strategies involve restoration or habitat enhancement. The strategies presented here for the East Kitsap DIP are divided into the following broad strategy types: protection and regulatory strategies, freshwater restoration and enhancement strategies, marine habitat strategies, and fisheries and other management strategies.

Table 5-1. Recovery Strategy Types and Strategies

Strategy Type	Strategy
Freshwater protection and regulatory strategies	Acquire and conserve priority steelhead habitat.
	Enforce and improve land use regulations.
	Protect water availability and water quality.
Freshwater habitat restoration and enhancement strategies	Remove barriers to fish passage and longitudinal connectivity.
	Improve lateral habitat connectivity in the floodplain.
	Increase channel complexity.
	Restore and improve functional riparian corridors.
	Increase hydrologic function and improve water quality.
Marine habitat strategies	Protect and restore forage fish spawning and rearing habitat.

Strategy Type	Strategy
	Address artificial haul-out sites of pinnipeds.
Fisheries management strategies	Reduce predation in freshwater lakes.
	Prevent illegal/incidental harvest.
	Explore possible native hatchery program.

Marine habitats are listed separately from freshwater because they are focused on foodweb function (providing buffer prey through forage fish abundance). This is based on the latest science from the Salish Sea Marine Survival Project. It is understood that steelhead migrate quickly through the estuary and nearshore in Puget Sound and are not using these habitats to rear or find refuge as other species do. Keeping the freshwater habitat strategies (protection and restoration) as a separate strategy type allows for a focus on the habitats that are directly used by steelhead for spawning, rearing and refuge in East Kitsap.

Additional operational strategies are also necessary to recover steelhead such as filling data gaps, developing a monitoring program, and funding the plan. Sections 7 and 8 address monitoring and data gaps.

5.3 Freshwater Protection Strategies

5.3.1 Acquire and Conserve Freshwater Habitat for Steelhead

This strategy addresses the future conversion of currently undeveloped lands within the East Kitsap DIP. Very few areas in the East Kitsap DIP are naturally protected from development through elevation or other features such as mountains or large estuaries, so direct protection of high priority, developable land is a key strategy to retain natural processes and habitat function. Protecting upland, wetland, and riparian habitats that are minimally impaired or have intact ecological function allows for hydrologic maturity over time and addresses the potential for future conversion of land cover for residential, commercial, and industrial uses. By limiting the conversion potential of undeveloped land, this strategy addresses riparian and floodplain processes by protecting peak and base streamflow, sediment loading, instream wood presence and recruitment, channel and floodplain complexity, water temperature, and foodweb function. This strategy also supports certain restoration actions.

Priority Pressures Addressed

☒	Roads & Culverts	☐	Predation	☐	Military Installations/RR
☐	Dams	☒	Water Withdrawals/Altered Flow	☐	Non-native Species
☒	Flood Control	☐	Hatcheries	☒	Mining
☒	Agriculture	☐	Harvest	☐	Commercial Aquaculture
☒	Timber Harvest	☒	Development (Residential, Commercial, Industrial)		

Contribution to Goals

☒	Forest cover	☒	Freshwater wetlands	☒	Riparian cover
☒	Floodplain function/connectivity (lateral)	☒	Accessibility/connectivity (longitudinal)	☒	Water availability
☐	Marine foodweb				

Relevant Steelhead Life Stages

☒	Egg incubation & emergence	☒	Outmigrating juveniles	☒	Adult spawning
☒	Juvenile rearing	☒	Adult migration, holding, and kelts		

Geographic Focus Areas

All seven subwatersheds, with emphasis/priority in Tier 1 steelhead drainages: Blackjack Creek, Chico Creek, Clear Creek, Curley Creek, Gorst Creek, and Grovers Creek.

Sub-strategies

- Align the Puget Sound Regional Council's Open Space Plan (2018) with local priorities, working with Bainbridge Island Land Trust, Great Peninsula Conservancy, Kitsap County and King County (Vashon); prioritize acquisitions and protections for priority steelhead habitat types and locations.
- Ensure Kitsap County's Conservation Futures Program is used as a tool for protecting priority salmon and steelhead habitat. Refer to other counties with transparent processes in coordination with Lead Entity/salmon recovery priorities.
- Encourage local governments to identify steelhead as a species of local importance and prioritize protective land use policies and regulations related to supporting steelhead recovery.
- Identify and prevent the conversion of at-risk timberlands to developed lands using:
    - Develop public-private partnerships to transition timberlands to protected status or protective uses.
    - Develop community forest models.
    - Identify opportunities for funding forest protection through carbon trading mechanisms; identify lessons learned from King County and Nisqually experiences.
- Continue to track and comment on Forest Practices Water Typing Modifications to ensure the use of best available science and protective approaches.
- Identify where Department of Natural Resources Trust Lands coincide with priority steelhead habitat and seek legislative support and funding to transfer parcels to open space.
    - Consider protective status for Upper Chico Creek as a Natural Resource Conservation Area.
- Incentivize agricultural programs to retain ecologically compatible use in productive floodplains and riparian habitats and prevent small parcel/rural-residential development.
    - Replicate the City of Bainbridge Island example to identify and zone for rural/agricultural benefits.

- Replicate the City of Port Orchard example of expanding protective zoning along Blackjack Creek.

- Assess the success of Kitsap County's Public Benefit Rating System (tax incentive) and improve program to enroll more landowners on or adjacent to key steelhead habitat.
- Ensure protection of identified critical aquifer recharge areas (CARAs) through acquisitions and incentives to private landowners in order to improve low flows and moderate flashy flows.
- Assess the local implications of NMFS's riparian buffer tables to standardize protocols and priorities for permanent riparian buffer easements; identify the best places to protect and focus incentive programs for buffers.
- Identify priority parcels that would qualify for DoD protections under the Readiness and Environmental Protection Integration (REPI) program.
- Align weed lists with salmon recovery so they include not only Class A noxious weeds, but also species that directly impact steelhead and their habitats, such as nightshade, reed canary grass, and others.

5.3.2 Enforce and Improve Land Use Regulations

This strategy addresses multiple pressures and stressors from residential/commercial/industrial development, particularly impervious cover, altered hydrology, loss of forest or riparian cover, and shoreline armoring. This is a critical strategy due to the current and projected level of development and the associated impacts on steelhead habitat.

Priority Pressures Addressed

☒	Roads & Culverts	☐	Predation	☐	Military Installations/RR
☐	Dams	☒	Water Withdrawals/Altered Flow	☐	Non-native Species
☒	Flood Control	☐	Hatcheries	☒	Mining
☒	Agriculture	☐	Harvest	☐	Commercial Aquaculture
☒	Timber Harvest	☒	Development (Residential, Commercial, Industrial)		

Contribution to Goals

☒	Forest cover	☒	Freshwater wetlands	☒	Riparian cover
☒	Floodplain function/connectivity (lateral)	☒	Accessibility/connectivity (longitudinal)	☒	Water availability
☒	Marine foodweb				

Relevant Steelhead Life Stages

☒	Egg incubation & emergence	☐	Outmigrating juveniles	☐	Adult spawning
☒	Juvenile rearing	☒	Adult migration, holding, and kelts		

Geographic Focus Areas

All seven subwatersheds, with emphasis/priority in Tier 1 steelhead drainages: Blackjack Creek, Chico Creek, Clear Creek, Curley Creek, Gorst Creek, and Grovers Creek.

Sub-strategies

- County and other jurisdictions to fully integrate recovery planning and comprehensive planning.
  - Add process-based habitat goals in the checklist of Kitsap County's Critical Areas Ordinance (CAO) to include the protection of aquifer recharge areas and channel migration zones from development.
- Assess the effectiveness of existing land use regulations (e.g., Growth Management Act, Shoreline Management Act) to protect floodplains, shorelines, riparian habitats, and other critical areas; identify regulatory gaps and needed enforcement tools.
- Perform systematic water type assessments to increase the effectiveness of HPAs and CAOs.
- Ensure adequate funding and staffing for all jurisdictions to enforce existing laws.
- Limit the exceptions, exemptions, variances, and administrative buffer reductions that result in decreased function of hydrologically sensitive areas and identify other regulatory gaps such as ambiguous language in the code, lack of data/maps.
- Provide education and outreach to homeowners to better understand regulations and their role in steelhead recovery.
- Prevent expansions or contract the current UGA boundaries and absorb growth inside the UGA.
- Where development in rural areas is most likely, encourage protection of connected habitat and utilize centralized, rather than dispersed, services (utilities, transit, etc.); track and prevent the permitting of "anchor buildings" such as churches and schools that lead to nearby residential development and the need for additional services.
- Prevent legislative changes that weaken or undermine Growth Management Act protections.
- Implement actions identified in the Blackjack, Curley, Chico, and Springbrook Creek watershed assessment plans that "maintain and expand protective zoning"; see Appendix C.
- Increase incentives (e.g., infrastructure and services) for developers to infill or redevelop property in cities and within Urban Growth Areas, while still protecting Critical Areas (e.g., buffers, streams, and wetlands).
- Jurisdictions designate Agricultural Resource Lands, or similar zoning classifications, in rural areas, prioritize rural-dependent uses over residential, and maintain and protect buffers of streams and wetlands in these zoning designations.

5.3.3 Protect Water Availability and Water Quality

This strategy addresses water availability and water quality that are not addressed by the above strategies (which focus on hydrologic function through protecting natural processes). This strategy addresses flood control infrastructure, water withdrawals, development, impervious surface run-off, and incentives for BMPs in areas of the East Kitsap DIP.

Priority Pressures Addressed

☒	Roads & Culverts	☐	Predation	☐	Military Installations/RR
☐	Dams	☒	Water Withdrawals/Altered Flow	☐	Non-native Species
☒	Flood Control	☐	Hatcheries	☒	Mining
☒	Agriculture	☐	Harvest	☐	Commercial Aquaculture
☐	Timber Harvest	☒	Development (Residential, Commercial, Industrial)		

Contribution to Goals

☐	Forest cover	☒	Freshwater wetlands	☐	Riparian cover
☐	Floodplain function/connectivity (lateral)	☐	Accessibility/connectivity (longitudinal)	☒	Water availability
☐	Marine foodweb				

Relevant Life Stages

☒	Egg incubation & emergence	☒	Outmigrating juveniles	☐	Adult spawning
☒	Juvenile rearing	☒	Adult migration, holding, and kelts		

Geographic Focus Areas

All seven subwatersheds, with emphasis/priority in Tier 1 steelhead drainages: Blackjack Creek, Chico Creek, Clear Creek, Curley Creek, Gorst Creek, and Grovers Creek.

Sub-strategies

- Ensure that the Department of Ecology's WREC projects for offsetting exempt wells address the needs of steelhead for groundwater.
  - Acquire water rights where instream flows are insufficient for steelhead due to water withdrawals
- Extinguish water rights if not used in 5 years, unless this results in perverse incentives.
- Local jurisdictions and water districts to develop and implement water recovery and reuse strategies.
- Local jurisdictions to utilize existing water reclamation infrastructure where it is present but not functional (e.g., Port Orchard retirement community); where not already underway, reclaim water at wastewater facilitates to replace water diversions for approved jurisdictional or private uses (golf courses, parks, etc.).
  - Develop standard operating procedures for maintenance.
  - Public education needed around reclaimed water, including the purpose of "purple pipes" and addressing water quality concerns.
  - Identify successful local and regional water reclamation efforts (Kitsap PUD example) and replicate in high priority areas.

- Jurisdictions to align National Pollutant Discharge Elimination System (NPDES) permit requirements with steelhead priorities; consider piloting issues such as:
  - Consider open space and park design with low impact development (LID).
  - Use schoolyards as an opportunity for jurisdictions to construct green stormwater infrastructure in novel locations.
- Protect beavers and their dams from removal and destruction in priority areas in coordination with WDFW and landowners. Ensure that beaver reintroductions, relocations, and beaver dam analogs are allowable where appropriate and in coordination with WDFW and landowners.
  - Identify suitable habitat for beaver relocation.
  - Incentivize landowners by offsetting flood risk with other amenities such as farm pads, move/lift structures, and/or improve drainage in other parts of property.

5.4 Freshwater Restoration and Enhancement Strategies

5.4.1 Remove Barriers to Fish Passage and Longitudinal Connectivity

This strategy addresses migration barriers to both juvenile and adult steelhead to allow full access to spawning and rearing habitat. Improved connectivity also benefits steelhead by improving natural processes related to sediment and wood transport and nutrient cycling.

Priority Pressures Addressed

☒	Roads & Culverts	☐	Predation	☒	Military Installations/RR
☒	Dams	☐	Water Withdrawals/Altered Flow	☐	Non-native Species
☐	Flood Control	☒	Hatcheries	☐	Mining
☐	Agriculture	☐	Harvest	☐	Commercial Aquaculture
☒	Timber Harvest	☐	Development (Residential, Commercial, Industrial)		

Contribution to Habitat Goals

☐	Forest cover	☐	Freshwater wetlands	☐	Riparian cover
☐	Floodplain function/connectivity (lateral)	☒	Accessibility/connectivity (longitudinal)	☐	Water availability
☐	Marine foodweb				

Relevant Life Stages

☐	Egg incubation & emergence	☒	Outmigrating juveniles	☐	Adult spawning
☒	Juvenile rearing	☒	Adult migration, holding, and kelts		

Geographic Focus Areas

While many streams in the East Kitsap DIP could benefit from barrier removal and opening habitat longitudinally, Tier 1 steelhead drainages should be prioritized for initial work: Blackjack Creek, Chico Creek, Clear Creek, Curley Creek, Gorst Creek, and Grovers Creek.

Sub-strategies

- Implement the culvert replacements identified in watershed assessment plans.
  - See fish passage projects in the 10-Year Start List (Appendix C).
- Expand barrier inventories to the historic extent of steelhead in the East Kitsap geography, and implement fish passage improvements as projects are identified and prioritized.
- Kitsap County and other jurisdictions to implement a fish passage inventory and prioritization process that also considers private culverts.
  - See examples in King County, Island County, Snohomish County, and Pierce Conservation District.
- Include assessments and removal of culverts in lower creek/intertidal areas of steelhead creeks and support science to understand how fish move and migrate to determine best approaches to passage from marine to freshwater systems, particularly in stream mouths.
- Use WDFW guidance on designing climate change resilient culverts and bridges (WDFW 2016).
- Avoid culvert repairs/maintenance or replacements that do not fully address fish passability (i.e., do not pass fish at all life stages) or have downstream impacts to steelhead or other salmonid habitat.
- Remove man-made dams and weirs that are passage barriers to steelhead.
- Work with DOD to correct passage barriers along the Navy railroad.
- Ensure that steelhead can access habitat above the Gorst and Grovers Creek hatcheries.
- Assist large private forest landowners to ensure that the Road Maintenance and Abandonment Plans (RMAPs) are completed to meet the 2021 deadline.
- Develop proposals to access the Family Forest Fish Passage Program funding for smaller forest landowners.

5.4.2 Improve Lateral Habitat Connectivity in the Floodplain

This strategy addresses and corrects past and ongoing land use actions that disconnect floodplains. This may include re-connecting or restoring off-channel wetlands, removing fill, armor, riprap, removing or setting back dikes, adding large wood to channels, or changing or eliminating dredging practices. Improved connectivity benefits steelhead by restoring hydrologic connection, sediment processes, wood recruitment, and transport and nutrient cycling. This strategy is closely related and often implemented in coordination with the strategy to increase channel complexity below. This is an important strategy for climate resilience to ensure hydraulic connections and lower temperatures during summer low flows. It also addresses channel scour of redds in the late winter/early spring during storms.

Priority Pressures Addressed

☒	Roads & Culverts	☐	Predation	☐	Military Installations/RR
☐	Dams	☒	Water Withdrawals/Altered Flow	☐	Non-native Species
☒	Flood Control	☐	Hatcheries	☐	Mining
☒	Agriculture	☐	Harvest	☐	Commercial Aquaculture
☐	Timber Harvest	☒	Development (Residential, Commercial, Industrial)		

Contribution to Habitat Goals

☐	Forest cover	☒	Freshwater wetlands	☒	Riparian cover
☒	Floodplain function/connectivity (lateral)	☐	Accessibility/connectivity (longitudinal)	☒	Water availability
☐	Marine foodweb				

Relevant Life Stages

☒	Egg incubation & emergence	☐	Outmigrating juveniles	☐	Adult spawning
☒	Juvenile rearing	☒	Adult migration, holding, and kelts		

Geographic Focus Areas

While many streams in the East Kitsap DIP could benefit from connected floodplains for hydrologic function and summer flows, Tier 1 steelhead drainages should be prioritized: Blackjack Creek, Chico Creek, Clear Creek, Curley Creek, Gorst Creek, and Grovers Creek.

Sub-strategies

- Remove riprap and other armoring where they reconnect floodplain and channel migration processes.
- Reconnect side channels and backwater and wetland habitat to stream channels.
- Increase roughness and address incised and disconnected channels in problem areas.
- Protect beavers and their dams from removal and destruction in priority areas in coordination with WDFW and landowners. Ensure that beaver reintroductions, relocations, and beaver dam analogs are allowable where appropriate and in coordination with WDFW and landowners (see 5.3.3 above)
- Implement the reconnection projects identified in the watershed assessment plans.
    - See floodplain connectivity projects in the 10-Year Start List (Appendix C).
- Develop watershed assessment plans and identify floodplain reconnection projects for Tier 1, Tier 2, and Tier 3 drainages that do not already have them (currently exist for Blackjack, Chico, Curley and Springbrook Creek watersheds).
- Remove (or replace where necessary) bridge and road crossing structures where they impede floodplain function and connectivity identified in the watershed assessment plans.

5.4.3 Increase Channel Complexity

This strategy relates to floodplain reconnection, but focuses on addressing the lack of structural features like wood, gravel, and overall channel complexity. Legacy conversion of uplands, floodplains, and riparian areas to agriculture or development results in the channel losing structural complexity. Active straightening, dredging, clearing, armoring, and removing inputs of wood and sediment have been common practices on the landscape that have simplified channels in the East Kitsap DIP. The strategy to increase complexity through restoration is often implemented in conjunction with other strategies (e.g. lateral connectivity as described above), but can be a standalone strategy focusing on improving habitat in stream reaches, including increasing pools for holding adults, providing adequate gravel sorting for spawning beds, and supporting refuge for rearing juveniles. Juveniles use the channel in different ways as they grow and mature, and for a variety of hiding, feeding, and overwintering needs.

Priority Pressures Addressed

☒	Roads & Culverts	☐	Predation	☐	Military Installations/RR
☐	Dams	☐	Water Withdrawals/Altered Flow	☐	Non-native Species
☒	Flood Control	☐	Hatcheries	☐	Mining
☒	Agriculture	☐	Harvest	☐	Commercial Aquaculture
☒	Timber Harvest	☒	Development (Residential, Commercial, Industrial)		

Contribution to Goals

☐	Forest cover	☐	Freshwater wetlands	☒	Riparian cover
☒	Floodplain function/connectivity (lateral)	☐	Accessibility/connectivity (longitudinal)	☒	Water availability
☐	Marine foodweb				

Relevant Life Stages

☒	Egg incubation & emergence	☐	Outmigrating juveniles	☒	Adult spawning
☒	Juvenile rearing	☒	Adult migration, holding, and kelts		

Geographic Focus Areas

In-stream complexity should be improved throughout the historic steelhead extent, and done in conjunction with passage improvement projects, but Tier 1 steelhead drainages should be prioritized: Blackjack Creek, Chico Creek, Clear Creek, Curley Creek, Gorst Creek, and Grovers Creek.

Sub-strategies

- Install large woody debris appropriate for local geology and geomorphology to increase stream complexity and create varied habitat to support juvenile rearing and other life history stages.
- Implement the channel complexity projects identified in the watershed assessment plans.
    - See channel complexity projects in 10-Year Start List (Appendix C).

- To prevent clearing of riparian vegetation and increase natural recruitment of wood, conduct public outreach on the benefits of downed wood in riparian areas and in streams.

5.4.4 Restore and Improve Functional Riparian Corridors

This strategy addresses the lack of shade, wood recruitment, and nutrient inputs resulting from development, agriculture, timber harvest, mining, and other pressures. This strategy is often implemented in conjunction with other strategies, but can be a standalone strategy in areas where riparian cover is currently lacking but necessary for shading, water quality, or future structural elements in a particular reach or subwatershed. This strategy also addresses locations where invasive vegetation is the predominant feature of the riparian zone, resulting in a variety of impacts on water quality, channel migration, nutrient inputs, and shading.

Priority Pressures Addressed

☐	Roads & Culverts	☐	Predation	☐	Military Installations/RR
☐	Dams	☐	Water Withdrawals/Altered Flow	☒	Non-native Species
☐	Flood Control	☐	Hatcheries	☒	Mining
☒	Agriculture	☐	Harvest	☐	Commercial Aquaculture
☒	Timber Harvest	☒	Development (Residential, Commercial, Industrial)		

Contribution to Goals

☐	Forest cover	☒	Freshwater wetlands	☒	Riparian cover
☒	Floodplain function/connectivity (lateral)	☐	Accessibility/connectivity (longitudinal)	☒	Water availability
☐	Marine foodweb				

Relevant Life Stages

☒	Egg incubation & emergence	☐	Outmigrating juveniles	☒	Adult spawning
☒	Juvenile rearing	☒	Adult migration, holding, and kelts		

Geographic Focus Areas

All seven subwatersheds would benefit from an increase in riparian cover, but Tier 1 steelhead drainages should be prioritized: Blackjack Creek, Chico Creek, Clear Creek, Curley Creek, Gorst Creek, and Grovers Creek.

Sub-strategies

- Remove invasive species and plant native vegetation in riparian areas; include diverse native species in planting palettes so that riparian zones adapt to climate change over time. Implement the riparian restoration projects identified in the watershed assessment plans.
    - See riparian projects in 10-Year Start List (Appendix C).

- Steward recently restored areas to ensure survival and growth of native cover.
- Install livestock fencing to exclude grazing and prevent bank erosion in riparian areas.
- Provide education, outreach, and technical assistance to streamside property owners (e.g., templates for riparian planting plans, assistance with designing habitat restoration, etc.).
- Prohibit and enforce overnight camping in sensitive habitat, particularly riparian areas.
- Expand jurisdictions' lists of non-native invasive species that are managed in parks and open spaces to include species that impede steelhead recovery (e.g. nightshade, Japanese knotweed, etc.).
- County and City Parks departments comply with CAO prohibitions on new use trails and consider closing existing use trails, particularly in critical areas, wetlands, and riparian buffers.

5.4.5 Increase Hydrologic Function and Improve Water Quality

This strategy addresses the critical importance of watershed processes and a functional hydrological system. Both water quantity and quality are important to protect and improve through such strategies as forest and wetland protection and restoration of riparian buffers. Most climate change impacts in the East Kitsap DIP are likely to result in changes to the hydrology, so additional effort is needed to mitigate or ameliorate those changes. Groundwater recharge and hyporheic connections are a critical element of maintaining flows and cool temperatures, particularly for juvenile steelhead that rear throughout the summer.

Priority Pressures Addressed

☒	Roads & Culverts	☐	Predation	☐	Military Installations/RR
☐	Dams	☒	Water Withdrawals/Altered Flow	☐	Non-native Species
☐	Flood Control	☐	Hatcheries	☒	Mining
☒	Agriculture	☐	Harvest	☐	Commercial Aquaculture
☒	Timber Harvest	☒	Development (Residential, Commercial, Industrial)		

Contribution to Goals

☐	Forest cover	☒	Freshwater wetlands	☐	Riparian cover
☒	Floodplain function/connectivity (lateral)	☐	Accessibility/connectivity (longitudinal)	☒	Water availability
☐	Marine foodweb				

Relevant Life Stages

☐	Egg incubation & emergence	☐	Outmigrating juveniles	☒	Adult spawning
☒	Juvenile rearing	☒	Adult migration, holding, and kelts		

Geographic Focus Areas

All seven subwatersheds need improved water quality and quantity, but Tier 1 steelhead drainages should be prioritized: Blackjack Creek, Chico Creek, Clear Creek, Curley Creek, Gorst Creek, and Grovers.

Sub-strategies

- Prioritize acquisition and restoration projects that protect or enhance hyporheic flow and connectivity.
- Protect beavers and beaver dams, and reintroduce and increase beaver populations in appropriate locations to increase hydrologic functions.
- Restore wetland complexes through passive and active restoration on former and current agricultural lands.
- Coordinate with the jurisdictions to identify existing stormwater facilities that should be prioritized for retrofit of run-off detention and water quality functions; support the implementation of high priority retrofit actions.

5.5 Marine Habitat Strategies

5.5.1 Protect and Restore Forage Fish Spawning and Rearing Habitat

This strategy addresses the need to ensure robust forage fish populations exist in the East Kitsap DIP as part of a larger regional strategy focused on ensuring buffer prey exists to increase survival of steelhead during their migration through Puget Sound. This is a recommendation from the Regional Plan based on findings of the Salish Sea Marine Survival Project. This strategy is not to provide a food source for steelhead, as is the case for Chinook and other salmon, but rather ensure that other prey species are present and abundant in Puget Sound for pinnipeds and other predators to feed on (hence the term “buffer prey”), providing a buffer for outmigrating steelhead as they move through Puget Sound.

Priority Pressures Addressed

☒	Roads & Culverts	☒	Predation	☒	Military Installations/RR
☐	Dams	☐	Water Withdrawals/Altered Flow	☐	Non-native Species
☐	Flood Control	☐	Hatcheries	☐	Mining
☐	Agriculture	☐	Harvest	☒	Commercial Aquaculture
☐	Timber Harvest	☒	Development (Residential, Commercial, Industrial)		

Contribution to Goals

☐	Forest cover	☐	Freshwater wetlands	☐	Riparian cover
☐	Floodplain function/connectivity (lateral)	☐	Accessibility/connectivity (longitudinal)	☐	Water availability
☒	Marine foodweb				

Relevant Life Stages

☐	Egg incubation & emergence	☒	Outmigrating juveniles	☐	Adult spawning
☐	Juvenile rearing	☐	Adult migration, holding, and kelts		

Geographic Focus Areas

All marine areas of East Kitsap

Sub-strategies

- Acquire and restore high-value nearshore habitat, particularly in relatively undeveloped marine shoreline areas of the East Kitsap DIP.
    - Implement the high priority projects in the West Sound Nearshore Integration and Synthesis of Chinook Salmon Recovery Priorities (2017) that include sediment supply and sediment transport benefits and overlap with known forage fish areas (use most recent forage fish survey data to select projects and locations).
- Provide incentives to nearshore landowners to protect habitat by avoiding armoring or using softshore approaches when considering armoring and moving at-risk infrastructure that is threatened by erosion.
- Support local government programs to educate waterfront homeowners about Shore Friendly Practices and fund incentive programs
- Enforce regulations on non-compliant or illegal armoring.
- Improve the function of marine shorelines, particularly embayments, eelgrass beds, and other shallow, low-velocity, fine-substrate habitats.
- Protect sediment delivery and transport processes from sources such as feeder bluffs and creek discharges, to support habitat formation and function.
- Remove hard armor or replace with softshore protection.
- Continue beach forage fish surveys to improve accuracy of spawning maps to ensure that WDFW has relevant information in permitting nearshore activities.
- Re-start acoustic-trawl (A-T) surveys of herring in East Kitsap and other parts of Puget Sound to improve estimates of herring spawn biomass (Puget Sound vital sign indicator) and other key biological information about herring (e.g., age composition).
- Determine overlap and impact of commercial shellfish with forage fish spawning areas; avoid or limit commercial aquaculture permits where they overlap with key forage fish habitat.
- County to develop In-Lieu-Fee program for nearshore degradation; use the West Sound Nearshore Integration and Synthesis Tier 1 and 2 projects as receiving sites.

5.5.2 Address Artificial Haul-out Sites of Pinnipeds

This strategy addresses the need to test whether pinniped congregations during steelhead smolt and adult migration can or should be managed to increase steelhead survival. Local efforts should be coordinated with leadership from the region (i.e., NMFS, WDFW, Puget Sound Partnership, Governor's Salmon Recovery Office).

Priority Pressures Addressed

☐	Roads & Culverts	☒	Predation	☒	Military Installations/RR
☐	Dams	☐	Water Withdrawals/Altered Flow	☐	Non-native Species
☐	Flood Control	☐	Hatcheries	☐	Mining
☐	Agriculture	☐	Harvest	☒	Commercial Aquaculture
☐	Timber Harvest	☒	Development (Residential, Commercial, Industrial)		

Contribution to Goals

☐	Forest cover	☐	Freshwater wetlands	☐	Riparian cover
☐	Floodplain function/connectivity (lateral)	☐	Accessibility/connectivity (longitudinal)	☐	Water availability
☒	Marine foodweb				

Relevant Life Stages

☐	Egg incubation & emergence	☒	Outmigrating juveniles	☐	Adult spawning
☐	Juvenile rearing	☒	Adult migration, holding, and kelts		

Geographic Focus Areas

All marine areas of East Kitsap

Sub-strategy

- Assess the role of East Kitsap haul-out sites in marine mortality for East Kitsap steelhead and other populations in the Central and South Steelhead MPG. See data gaps section for more details.

5.6 Fisheries Management Strategies

5.6.1 Reduce Predation in Freshwater Lakes

This strategy addresses the predation on juvenile steelhead in freshwater lakes, ponds and connected streams by non-native piscivorous fish. Several lakes in the East Kitsap DIP that are connected to anadromous waters are planted with non-native rainbow trout and/or have naturalized populations of warm water species from previous plantings.

Priority Pressures Addressed

☐	Roads & Culverts	☒	Predation	☐	Military Installations/RR
☐	Dams	☐	Water Withdrawals/Altered Flow	☒	Non-native Species
☐	Flood Control	☒	Hatcheries	☐	Mining
☐	Agriculture	☐	Harvest	☐	Commercial Aquaculture
☐	Timber Harvest	☐	Development (Residential, Commercial, Industrial)		

Contribution to Goals

Improves steelhead VSP goals. This recovery strategy does not operate via improvements to habitat or other ecological functions, but acts directly on the steelhead population.

Relevant Life Stages

☐	Egg incubation & emergence	☐	Outmigrating juveniles	☐	Adult spawning
☒	Juvenile rearing	☐	Adult migration, holding, and kelts		

Geographic Focus Areas

Lakes and ponds, and connected streams throughout the East Kitsap DIP (including but potentially not limited to Wildcat Lake, Kitsap Lake, Island Lake, Long Lake, and Carpenter Lake).

Sub-strategies

- Consistent with WDFW policy in the Statewide Steelhead Management Plan, the agency should cease rainbow trout plantings in lakes within the anadromous zone.
- Work with WDFW to develop a bounty on non-native species that are documented to prey on steelhead in East Kitsap.

5.6.2 Prevent Illegal and Incidental Harvest

This strategy addresses harvest pressure from illegal poaching and incidental harvest. As steelhead populations increase and adult returns are likely to attract illegal poaching, as seen in Hood Canal and elsewhere, increase WDFW and Tribal enforcement. Because adult returns are currently low in the East Kitsap DIP, any amount of poaching on adults or kelts could have major consequences to the population's ability to recover.

Priority Pressures Addressed

☐	Roads & Culverts	☐	Predation	☐	Military Installations/RR
☐	Dams	☐	Water Withdrawals/Altered Flow	☐	Non-native Species
☐	Flood Control	☐	Hatcheries	☐	Mining
☐	Agriculture	☒	Harvest	☐	Commercial Aquaculture
☐	Timber Harvest	☐	Development (Residential, Commercial, Industrial)		

Contribution to Goals

Improves steelhead VSP goals. This recovery strategy does not operate via improvements to habitat or other ecological functions, but acts directly on the steelhead population.

Relevant Life Stages

☐	Egg incubation & emergence	☐	Outmigrating juveniles	☒	Adult spawning
☐	Juvenile rearing	☒	Adult migration, holding, and kelts		

Geographic Focus Areas

Focus on Tier 1 and Tier 2 drainages (particularly where "put and take" fisheries occur on lakes).

Sub-strategies

- To prevent incidental take during recreational fishing, conduct creel surveys, including incidental catch of steelhead and other native species.
- Post signage about the identification of listed species at popular fishing locations and poaching enforcement signs at areas most likely to attract poachers.
- WDFW and Tribes to iIncrease enforcement in areas where poaching of adult steelhead is most likely.

5.6.3 Explore Possible Native Hatchery Program

This strategy addresses the fact that the East Kitsap DIP population abundance is chronically depressed and currently far from the recovery goals and that emergency supplementation of spawners and smolts may be required to initially produce sufficient numbers of fish to prevent extirpation. Before considering the implementation of any such program, an analysis is needed of benefits and risks, and lessons learned from a similar effort for steelhead in Hood Canal in coordination with NMFS, and WDFW. Other example programs include Hood Canal summer chum. While this strategy is included within the plan, it may be several years before basic population and habitat information is gathered and a decision is made as to whether an East Kitsap steelhead supplementation program would be warranted.

Priority Pressures Addressed

This strategy does not reduce or ameliorate a specific pressure; however, all cumulative pressures on steelhead have resulted in a very low abundance and the need to consider utilizing this recovery strategy.

Contribution to Goals

Improves steelhead VSP goals. This recovery strategy does not operate via improvements to habitat or other ecological functions, but acts directly on the steelhead population.

Relevant Life Stages

☐	Egg incubation & emergence	☒	Outmigrating juveniles	☒	Adult spawning
☐	Juvenile rearing	☐	Adult migration, holding, and kelts		

Geographic Focus Areas

To be determined based on an assessment of population and habitat characteristics in East Kitsap, and in communication with NMFS researchers in Hood Canal.

Sub-strategies

- Evaluate the Hood Canal Steelhead Project to determine whether it is effective for increasing population abundance and productivity, and if it is replicable as is or as modified to suit conditions in the East Kitsap DIP.
- If warranted, develop East Kitsap-specific program for priority systems.

5.7 Linking Strategies to Recovery Goals

Because no single strategy is likely to achieve the necessary outcomes to reach a goal, the table below summarizes the strategies that contribute to each of the recovery goals described in Sections 3.3 and 3.4. All of the strategies above are deemed necessary to meet the population goals for the East Kitsap DIP. Prioritizing, sequencing and implementing strategies will largely be based on available funding, stakeholder engagement, community support, and political will. These are further described in the Implementation and Adaptive Management sections that follow.

Table 5-2. Strategies and Recovery Goals

Contributing Strategies	Recovery Goal
Acquire and conserve priority steelhead habitat	Upland Forest Cover
Enforce and improve land use regulations	
Acquire and conserve priority steelhead habitat	Freshwater Wetlands
Enforce and improve land use regulations	
Protect water availability and water quality	
Improve lateral habitat connectivity in the floodplain	
Restore and improve function riparian corridors	
Increase hydrologic function and improve water quality	
Acquire and conserve priority steelhead habitat	Riparian Areas
Enforce and improve land use regulations	
Improve lateral habitat connectivity in the floodplain	

<table>
<tr><th>Contributing Strategies</th><th>Recovery Goal</th></tr>
<tr><td>Increase channel complexity</td><td rowspan="2"></td></tr>
<tr><td>Restore and improve function riparian corridors</td></tr>
<tr><td>Remove barriers to fish passage and longitudinal connectivity</td><td rowspan="2">Stream Channel: Accessibility (longitudinal connectivity)</td></tr>
<tr><td>Enforce and improve land use regulations</td></tr>
<tr><td>Acquire and conserve priority steelhead habitat</td><td rowspan="6">Stream Channel: Floodplain Function (lateral connectivity)</td></tr>
<tr><td>Enforce and improve land use regulations</td></tr>
<tr><td>Improve lateral habitat connectivity in the floodplain</td></tr>
<tr><td>Increase channel complexity</td></tr>
<tr><td>Restore and improve function riparian corridors</td></tr>
<tr><td>Increase hydrologic function and improve water quality</td></tr>
<tr><td>Acquire and conserve priority steelhead habitat</td><td rowspan="7">Water Availability</td></tr>
<tr><td>Enforce and improve land use regulations</td></tr>
<tr><td>Protect water availability and water quality</td></tr>
<tr><td>Increase hydrologic function and improve water quality</td></tr>
<tr><td>Improve lateral habitat connectivity in the floodplain</td></tr>
<tr><td>Increase channel complexity</td></tr>
<tr><td>Restore and improve functional riparian corridors</td></tr>
<tr><td>Enforce and improve land use regulations</td><td rowspan="3">Marine Foodweb</td></tr>
<tr><td>Protect and restore forage fish spawning and rearing habitat</td></tr>
<tr><td>Address artificial haul-out sites of pinnipeds</td></tr>
</table>

6 IMPLEMENTING THE PLAN

6.1 Implementation Approach

The strategies and sub-strategies described in Section 6 are intended to be implemented through projects and actions by a variety of stakeholders in East Kitsap. Each stakeholder plays a unique role in steelhead recovery and a wide variety of entities will be needed to execute the strategies (See Table 6-1).

Table 6-1. Responsible Entities for Strategy Implementation

Strategy	Responsible entities
Acquire and conserve priority steelhead habitat.	Counties, cities, Tribes, land trusts, WDNR, WDFW
Enforce and improve land use regulations.	Counties, cities, Tribes, non-profit partners
Protect water availability and water quality.	Counties, cities, utilities, Tribes, non-profit partners, WDOE, EPA, Navy
Remove barriers to fish passage and longitudinal connectivity.	Counties, cities, private landowners, non-profit partners, WDFW, WSDOT, Navy
Improve lateral habitat connectivity in the floodplain.	Project sponsors (Counties, cities, Tribes, non-profit partners, WDFW)
Increase channel complexity.	Project sponsors (Counties, cities, Tribes, non-profit partners, WDFW)
Restore and improve functional riparian corridors.	Counties, cities, Tribes, private landowners, project sponsors
Increase hydrologic function and improve water quality.	Counties, cities, Tribes, private landowners, non-profit partners, WDFW, WDOE, EPA
Protect and restore forage fish spawning and rearing habitat.	Counties, cities, Tribes, non-profit partners, WDFW, Navy
Address artificial haul-out sites of pinnipeds.	NMFS, Tribes, WDFW, PSP, Navy
Reduce predation in freshwater lakes.	WDFW, Tribes
Prevent illegal/incidental harvest.	WDFW, Tribes
Explore possible native hatchery conservation program.	NMFS, Tribes, WDFW

Specific protection and restoration strategies which could be implemented by different stakeholders using a variety of local, regional, and national funding sources are further described in 10-year Start List in Appendix C. This list is a collection of recovery projects and action opportunities throughout the East Kitsap DIP, and sourced from four recent watershed restoration plans:

- The Chico Creek Watershed Assessment for the Identification of Protection and Restoration Actions (2014), prepared by Natural Systems Design and ICF International for The Suquamish Tribe.
- The Blackjack Creek Watershed Assessment and Protection and Restoration Plan (2017), prepared by ESA for The Suquamish Tribe.

- The Curley Creek Watershed Assessment and Protection and Restoration Plan (2017), prepared by Natural Systems Design and ICF International for the Suquamish Tribe.
- The Springbrook Creek Watershed Assessment (2018) led by the Bainbridge Island Land Trust with partners: Bainbridge Island Watershed Council, Wild Fish Conservancy Northwest, and the City of Bainbridge Island.

Appendix C currently includes the freshwater restoration and protection projects and actions that can be implemented immediately or as soon as funding is available. The projects included in Appendix C have been vetted as part of the overall review process under each assessment plan. While there are undoubtedly many other potential projects and actions in the East Kitsap area that would benefit steelhead and help implement the strategies identified in Section 6, they are not currently reflected in Appendix C.

The 10-Year Start List (Appendix C) includes capital projects by categories, which correspond directly to a strategy or sub-strategy in Section 5. These include: fish passage, floodplain restoration, riparian plantings, and increased channel complexity. In addition, there are land use, zoning, and acquisition actions and miscellaneous (e.g., stormwater controls). The summary information for each project in Appendix C includes the project ID, project name, description, and project outcome.

In some cases, additional information on the projects and actions can be found in the plan documents listed above including the site-specific problem, proposed approach to fixing the problem, the proposed location, outcome, and in some instances, a sponsor. The table includes the page number from the source document and whether photographs of the site are available.

Additional projects and actions should be further identified, described, and vetted to further build out the 10-Year Start List. This may be done through developing additional watershed assessments for areas like Dogfish Creek, Clear Creek, Gorst Creek, and others. Several conceptual projects and actions identified in Appendix C require a sponsor, cost estimate and additional work to prepare them for inclusion in the 4-year work plan. Additional existing or new opportunities may be vetted and included as part of the 4-year Work Plan process by sponsors or other recovery stakeholders. This process should identify the steelhead recovery strategy or sub-strategy(ies) that the project or action is implementing.

The actions that implement the marine strategies are focused on forage fish to improve the function of the marine foodweb and increase steelhead survival during their outmigration. These are consistent with the actions being implemented locally for Chinook salmon recovery, and are currently represented in the Lead Entity's 4-year Work Plan. Additional actions to protect and restore forage fish are available in the West Sound Nearshore Integration and Synthesis of Chinook Salmon Recovery Priorities (2017) and in the Salmon Habitat Plan for the Green/Duwamish and Central Puget Sound Watershed (2005).

Similar to additional freshwater habitat projects, the projects within the East Kitsap boundary should be vetted and included in the WSPER 4-year work plan process. Projects on Vashon Island (King County) should be vetted and included in the Green/Duwamish/Central Puget Sound (WRIA 9) Lead Entity process.

Funding and political will are two critical elements for implementation of this plan. While the prioritization of individual projects and actions should be aligned with specific funding tools and prioritized as part of annual or biennial grant rounds, an overall prioritization of strategies and actions should be part of an adaptive management program (see Section 9). Project readiness, benefits, and clear connection to a recovery strategy will assist in competitive projects for funding. Funding sources like the

WDFW Fish Passage Barrier Removal Board, Family Forest Fish Passage Salmon Recovery Funding Board, and PSAR should be sought to fund and implement the capital projects for habitat improvements in this plan. Department of Ecology programs, EPA's National Estuary Program, and others should be sought to fund water quantity and quality improvements. Local funding for protection and cost-share programs are critical for recovery, along with protective actions undertaken through policy change, regulations, and enforcement.

6.2 Implementation Targets

While recovering steelhead will require far more than funding specific habitat restoration and acquisition projects, it is important to identify short-term targets and track progress. In addition, setting and tracking implementation metrics can assist with adaptive management (further described in Section 9) and help answer questions such as:

- What subwatersheds or drainages are receiving the majority of restoration actions?
- How many actions have been completed that contribute to each habitat goal?
- What funding sources are contributing to each goal?

To develop the implementation targets, the projects from the 10-Year Start List (Appendix C) were tallied. These represent 10-year targets and should be further developed by including additional actions in other subwatersheds. Currently, implementation targets are focused on the number of projects implemented, and not specific habitat metrics. While some project outcomes described in Appendix C are specific and include habitat metrics (e.g. X stream miles accessible after passage barrier improvement or Y acres of riparian area restored), most outcomes are described in a general, qualitative manner. As more information is generated regarding these projects, implementation targets will be improved with specific habitat metrics through the adaptive management process.

Each of the implementation targets are shown in relation to the long-term habitat goals they contribute to (Table 6-2), which were described in Section 3.

Table 6-2. Project Implementation Targets and Relationship to Habitat Goals

Long-term Habitat Goals	Short-term Implementation Targets
Habitat Goal: **Upland Forest** By 2070, there is no loss of forest cover and extent is increased to or exceeds 65% in all seven subwatersheds.	Complete **9 forest protection projects** by 2030.
Habitat Goal: **Freshwater Wetlands** By 2070, freshwater wetland extent is increased beyond the current status in all seven subwatershed.	No specific projects identified. See floodplain and riparian projects.
Habitat Goal: **Riparian Areas** By 2070, riparian cover in all steelhead streams is increased; in the Tier 1 drainages the riparian cover exceeds the current levels.	Complete **24 riparian restoration projects** by 2030.

Long-term Habitat Goals	Short-term Implementation Targets
Habitat Goal: **Stream Channel: accessibility (longitudinal connectivity)** By 2030, steelhead can access 100% of historically accessible habitat in all six of the Tier 1 drainages (Blackjack, Chico, Curley, Clear, Gorst, Grover). By 2070, steelhead can access 100% of historically accessible habitat throughout the East Kitsap DIP geography.	Complete **28 barrier removal or improvement** projects by 2030.
Habitat Goal: **Stream Channel: floodplain function (lateral connectivity)** By 2070, increase connectivity and floodplain function in all major steelhead drainages.	Complete **28 floodplain connectivity** projects by 2030.

7 MONITORING FRAMEWORK

Monitoring is the act of collecting and evaluating information needed to answer questions related to how well a strategy or action is working, and helps to identify the conditions under which strategies or actions are likely to succeed or fail. Monitoring for steelhead recovery in the East Kitsap DIP should be conducted to answer the following questions:

1) What is the overall status of the steelhead population and habitat quality and quantity?
2) Are the pressures identified as causing habitat degradation increasing or decreasing?
3) Are actions being carried out as recommended to implement the strategies?
4) Are the actions having the desired effect on the habitat quality or quantity?

This section describes a monitoring framework that addresses these purposes by proposing possible indicators to consider for long-term monitoring of steelhead recovery in the East Kitsap DIP. A full monitoring plan is beyond the scope of this plan, but would identify specific monitoring questions and include detailed protocols, cost estimates, frequency, and data management methods. The monitoring indicators identified below are organized by three types: ecological, pressure reduction, and implementation. Generally, implementation indicators are monitored as a matter of course in funding and tracking projects by the Lead Entity and are relatively inexpensive and done more frequently; whereas ecological indicators require extensive field or geographic information system (GIS) analysis, and are more expensive and conducted less frequently. This framework does not include effectiveness monitoring of specific protection/restoration project types; this information may be gathered from other entities protecting and restoring steelhead habitat in adjacent DIPs or even other listed stocks of steelhead on the West Coast.

7.1 Ecological and Population Monitoring

Section 3 includes a short list of habitat goals that focus on the most important habitat elements for conservation and recovery of steelhead in the East Kitsap DIP. These goals are proxies for a larger set of habitat processes that will improve the available and functional habitat for steelhead if the goals are met. At a minimum, the indicators to track in the ecological monitoring category are those that directly measure progress toward the goal, which are generally habitat type extent. Additional indicators that track landscape context, condition, or other aspects of the habitat function are also included below (Table 7-1). These more specific indicators were compiled from the Blackjack and Curley Creek Watershed Assessments (ESA 2017; NSD and ICF 2017).

Table 7-1. Habitat Indicators

Habitat	Indicator	Metric	Type	Reports on progress toward habitat goal
Upland	Forest cover	% cover	Extent	**Yes**
Freshwater wetlands	Wetland cover	Acres and % cover	Extent	**Yes**
		Connectivity	Landscape context	
Riparian area	Riparian forest cover	% cover within 200 feet of channel*	Extent	**Yes**
	Riparian structure – composition and seral stage	Tree height; species diversity	Condition	
Stream channel	Accessibility/longitudinal connectivity	% accessible of historic extent	Extent	**Yes**
	Lateral connectivity	Length of stream or area of floodplain restored	Extent	**Yes**
	Pool frequency and depth	Spacing between pools; mean and residual pool depth	Landscape context; Condition	
	Large wood volume	Key pieces per mile or cubic meters per 100 m	Condition	
	Sinuosity	Channel length/ valley length	Condition	
	Beaver pond frequency	Number of beaver ponds per length of channel; area and % ponded water	Condition	
Lakes	Intact shoreline	% cover within 200 feet of lake	Extent	
Marine shorelines	Intact shoreline	Miles of unarmored shoreline	Extent	
	Intact feeder bluff	Miles of unarmored feeder bluffs	Extent	
Water quantity	Low flows	7-day low flow	Condition	
	Annual maximum flows	Peak instantaneous flow during a water year	Condition	
Water quality	Water quality – temperature	7-day average daily maximum	Condition	
	Water quality – dissolved oxygen	--	Condition	
	Benthic diversity	Benthic Index of Biotic Integrity (B-IBI)	Condition	

*Use the common indicator metric and protocols once finalized by PSEMP

Monitoring fish population parameters in the East Kitsap DIP is important to track overall progress toward recovery. While the various metrics and tools for monitoring salmonid populations are well established, direct monitoring of steelhead can be even more difficult and expensive than monitoring other salmonids because of the timing of river entry and spawning and difficulties with identification. As technology offers improved methods for remote and automated monitoring, additional indicators and metrics may be easier to monitor. A subset of the population indicators in Table 7-2 would be sufficient for an East Kitsap monitoring plan and provide far more than is currently known.

Table 7-2. Status and Trends of Relevant Fish Population Indicators - Follows Viable Salmonid Population Parameters

Population parameter	Indicator	Method	Notes/other
Abundance	# of spawners	Fish in monitoring	
	# of kelts	Fish out monitoring/smolt trap	Indicator of future productivity
Productivity	Out-migrants per spawner	Smolt trap	
	Number and size of redds	Redd count	Can be used to estimate abundance / # of spawners
Spatial structure	Distribution of spawners	Redd count/e-DNA	
Life history diversity	Timing of juvenile outmigrants	Smolt trap	
	Age structure of juvenile out-migrants	Smolt trap	
	Size of juvenile out-migrants	Smolt trap	
	Relatedness	Tissue samples	Population genetics analysis to determine relatedness among sub-watersheds, hatchery introgression, and effective populations size

The Puget Sound Regional Steelhead Recovery Plan calls for establishing and maintaining long-term, annual monitoring of steelhead and kelt abundance, adult age structure, and smolt abundance and age in at least eight sites within Puget Sound, including two in the Central and South Sound MPG (NMFS 2019). The East Kitsap DIP should be one of the two sites to improve local and regional understanding of steelhead in low-elevation, rain-dominated systems.

In addition, beaches should continue to be surveyed and monitored for forage fish spawning due to their importance to steelhead as potential buffer prey. Consider broadening the monitoring program to include other buffer prey species such as herring. The Suquamish Tribe and WDFW conduct monthly surveys for forage fish eggs (although limited primarily to surf smelt) along beaches in East Kitsap, and WDFW conduct surveys for herring spawning (see online WDFW forage fish spawning map). A citizen science effort on Vashon Island monitors for forage fish with guidance from King County and the Vashon Nature Center.

7.2 Pressures Monitoring

Tracking the extent or impact of pressures provides information on the health of the ecosystem for steelhead. In some cases, it is less costly and easier to monitor indicators of degradation rather than ecosystem function. This is particularly the case when GIS and aerial imagery are used to assess metrics (e.g., roads per square mile as opposed to extent of connectivity). The list of pressures and indicators below may substitute or enhance the indicators in the list above to establish a more comprehensive understanding of the overall health of watersheds and steelhead populations. It is not necessary or suggested that every pressure have an associated indicator. The list below is an example of the most commonly used indicators and metrics that could be part of an East Kitsap monitoring plan.

Table 7-3. Relevant Pressure Reduction Indicators

Pressures or stressors	Indicator	Metric	Notes/other
Residential/commercial/ industrial development	Impervious surface	% impervious	
	Rate of development	New housing units inside and outside UGA	Department of Commerce regional housing growth maps: https://www.commerce.wa.gov/serving-communities/growth-management/puget-sound-mapping-project/
	Armored marine shoreline	Miles of armored shoreline # of permits for shoreline armoring	Combine with military installations
	Armored freshwater shoreline	Miles of riprap or other armoring # of permits for bank stabilization	
	Overwater structures	# or acres of overwater structures	Combine with military installations
Conversion	Land use/Land cover	% conversion by land use type	High resolution change detection: http://www.pshrcd.com/#/intro
	Land use/Land cover	# of variances allowed by jurisdiction	
Roads and culverts	Road network	Length of roads/square mile Number of stream crossings	

Pressures or stressors	Indicator	Metric	Notes/other
Mining	Number and location of permits issued		May be more useful to track through forest property sales if new property purchased from timber companies
Flood control – dredging	Number and location of permits issued		
Timber harvest	Number and location of leases		
Military installations	Armored marine shoreline	Miles of armored shoreline	Combine with residential analysis
	Overwater structures	# and/or square footage of overwater structures	Combine with residential analysis
	Artificial pinniped haulouts	# and extent of artificial haulouts	
Commercial aquaculture	Number and location of new leases		
Water withdrawals	Number and location of new residential wells	# and location of permits	Monitor exempt wells through WREC process
	Non-residential wells	# and location of permits	

7.3 Implementation Monitoring

Implementation monitoring tracks positive impacts on the watershed through projects, actions, and programs. This is the least expensive form of monitoring and often conducted as part of grant program administration. The most basic reporting elements for a recovery plan are number of projects implemented under each strategy. The list below may be tracked using common databases for salmon recovery projects in the state, such as Salmon Recovery Portal, PRISM database, or local tracking. Not all strategies are included in Table 7-4. The list provides a starting point for possible implementation monitoring and should be tailored as part the development of a final East Kitsap steelhead monitoring plan.

Table 7-4. Relevant Implementation Monitoring Indicators

Strategy type	Strategy	Implementation Indicators
Protection and regulatory	Acquire and conserve priority steelhead habitat.	Acres of habitat acquired (upland, wetland, floodplain, etc.). Enrollment in Public Benefit Rating System. Number of easements purchased by land trusts.
	Protect water availability and water quality.	CFS or acre/feet of water rights acquired. Number of water reclamation projects operational or underway.
Freshwater habitat restoration and enhancement	Remove barriers to fish passage and longitudinal connectivity.	Number of blockages/barriers removed or improved (see Implementation Target in Section 7) Number of miles of stream made passable.
	Improve lateral habitat connectivity in the floodplain.	Linear feet of arming removed. Linear feet of freshwater shoreline restored. Area of floodplain restored
	Increase channel complexity.	Number/volume of log jams installed.
	Restore and improve functional riparian corridors.	Acres of riparian area planted/treated. Acres of invasive vegetation removed/ treated.
	Increase hydrologic function and improve water quality.	Acres of upland protected. Increased wetted area
Marine habitat	Protect and restore forage fish spawning and rearing habitat.	Number of marine overwater structures removed (or improved).
Fisheries management	Reduce predation in freshwater lakes.	

7.4 Developing a Monitoring Program

The tables above include different metrics and indicators that may be tracked at a variety of scales, at different frequencies, and for specific purposes. It is not intended that all of these could or should be monitored or that resources are available to do so. A full monitoring plan exclusive to steelhead is beyond the scope of this recovery plan. An integrated monitoring plan for East Kitsap that includes steelhead as well as other salmonids should be developed to prioritize indicators and develop protocols for data collection, interpretation and reporting on monitoring outcomes. The monitoring plan should also indicate cost and ideally identify funding sources for developing a monitoring program.

Several indicators may already be monitored by regional or local project partners, such as those summarized in the State of our Watersheds report by the Northwest Indian Fisheries Commission. Other indicators may have data collected by the Washington Department of Ecology, Washington Department of Fish & Wildlife or NOAA (e.g. Coastal Change Analysis Program (C-CAP) data, or WDFWs HRCD for riparian and upland forest change). These data may require relatively minor analysis and GIS support to summarize results and apply to East Kitsap.

8 DATA GAPS AND INFORMATION NEEDS

This section captures a list of priority data gaps and information needs that have been identified while preparing this recovery plan. A number of gaps emerged for both the species and habitat in the East Kitsap DIP. Additional data gaps and information needs will likely be uncovered and identified by recovery partners as this plan is implemented; thus, the following list should be considered in progress. Prioritizing which data gaps to fill first should be based on what would most inform adaptive management of the plan, starting with the information necessary to understand the status and trends of the habitat and steelhead (meta-)populations. A full prioritization of the gaps is outside the scope of the plan and will be largely based on cost and available resources.

8.1 Gaps in Steelhead Population Information

Little information exists on current and historic steelhead use of most drainages in the East Kitsap DIP. A 2018 report by WDFW shows insufficient data to determine a number of risk criteria for the DIP (Cram et al 2018). No systematic adult escapement monitoring has been conducted. Data on the distribution and abundance of rainbow trout (resident *O. mykiss*), and their interactions with anadromous fish in the East Kitsap DIP are also lacking. An ongoing project using eDNA sampling in WRIA 15 (Wild Fish Conservancy 2018a) is providing additional steelhead distribution data (i.e., of *O. mykiss*).

The general lack of information on steelhead in the East Kitsap DIP presents significant management challenges, as well as an opportunity to study the current use and abundance of steelhead in the DIP. Although not fully understood, alteration and loss of floodplain and wetland habitat, a reduction in forest cover, urbanization, and agriculture (i.e., pastureland and hobby farming) are likely freshwater habitat limiting factors for steelhead in East Kitsap (Nash 2017). The combination of increased impervious surfaces from urbanization and climate change may also be limiting steelhead production, due to streamflow alterations and warmer stream temperatures.

The *Methods and Quality of VSP Monitoring of ESA Listed Puget Sound Salmon and Steelhead* (PSEMP 2012) identified the following two highest priorities for funding of steelhead monitoring in the East Kitsap DIP:

- Collection and analysis of DNA samples from juvenile migrant steelhead taken in migrant traps, as there is little known about the genetic diversity of steelhead in this area. Adult steelhead are seldom collected, but traps designed to enumerate other species sometimes catch steelhead migrants.
- Available nearshore data, as the result of recent studies, needs to be published and available for analysis. (This should be focused on forage fish to align with the latest science and strategies described above.)

PSEMP (2012) and WDFW (2018) assessed the status of steelhead population monitoring in the East Kitsap DIP as deficient, as was the case for all but six populations in Puget Sound. In addition, the VSP monitoring assessment for steelhead showed a poor ability to determine overall adult steelhead abundance in the East Kitsap DIP, with spawner abundance programs limited to surveys conducted sporadically.

Based on the dearth of information on steelhead distribution, abundance, productivity, and genetic information in the East Kitsap DIP, data should be collected for all of these parameters. Filling these gaps would allow for population goals to be refined based on site-specific data and aid the implementation of the recovery plan, as well as provide data to assess plan success in meeting the population goals, and assist in determining how to adaptively manage strategies in the future (e.g. hatchery supplementation).

The following data gaps were also identified that would assist in the adaptive management process to refine strategies, monitor progress, and better understand threats:

- Ability to distinguish steelhead from rainbow trout use, extent, and interactions in the East Kitsap DIP.
- Numbers of kelts and importance of iteroparity in productivity of the DIP.
- Understand how steelhead use small, independent systems and how genetic diversity and spatial structure should be considered in that context.
- Focused monitoring of sub-populations in drainages most likely to be selected for potential future supplementation programs (e.g., Chico Creek); understanding run size, stock structure, and genetic diversity is important for pre-treatment information and for planning a program with NMFS and co-managers.
- Assess smolt and adult mortality in Puget Sound from pinnipeds and other predators; assess the role of artificial haul-out sites on mortality
- Presence and impact of disease (*Nanophyetes salminicola)* and contaminants (especially flame retardants) on smolts and early marine survival.
- Analysis of coded wire tags and catch data from all fisheries to understand the impacts of harvest on steelhead.

Once the data gaps are filled for life-history and status information, additional recovery goals should be developed for spatial structure as well as genetic diversity.

8.2 Gaps in Ecological and Habitat Information

As described above, the lack of information on steelhead in the East Kitsap geography leads to uncertainty in how to best manage the species for all four viability parameters. In some ways, this points to a conservative approach that should protect as many habitat types as possible so that as many life histories can be recovered and/or evolve in a changing system due to climate and land use impacts.

Addressing the following gaps would assist in adaptively managing and recovering steelhead in Puget Sound overall and the East Kitsap DIP specifically:

- Develop habitat goals for forest condition related to hydrologic maturity. Current forest goals only cover extent of forest and not quality or function.
- Historic extent of wetlands for all subwatersheds and estimates of stream-adjacent wetlands for individual drainages.
- Develop goals, identify metrics, and current status of floodplain connectivity in East Kitsap.
- Current status of stream habitat accessibility as a percentage of steelhead historic extent.
- Habitat use by steelhead during summer low flows and the impacts from climate change on this distribution.

- Develop goals or objectives for water quantity and quality specific to steelhead recovery.
- Key forage fish species, locations, and contribution to local steelhead smolt survival.
- Pinniped response to localized haul-out removals, alterations, or other actions allowable under the Marine Mammal Protection Act.
- Impacts of commercial shellfish and net pen aquaculture on local forage fish abundance and productivity.

9 ADAPTIVE MANAGEMENT

9.1 Approach

This recovery plan was developed through an adaptive management framework. The regionally accepted and adopted tool, Open Standards for the Practice of Conservation, was used throughout the planning process, with the understanding that gaps in information will be filled and new research on Puget Sound steelhead will advance in tandem with implementation of the strategies presented in the plan. This section describes the framework and process for adaptive management to actively incorporate new information and change course as needed. A toolkit developed to assist Chinook recovery teams with plan development (PSP 2016) was used with this plan to develop and document the local adaptive management approach, using the standard steps of an adaptive management cycle:

1) Set a vision and identify goals.
2) Plan actions and identify monitoring needs.
3) Implement and monitor.
4) Analyze data and use the results to adapt assumptions and approach.
5) Capture lessons learned and share results.

9.2 Incorporating New Information

Previous sections in this recovery plan establish a vision and articulate both quantitative and qualitative goals for steelhead and the habitats they depend on. The plan also identifies the elements that need to be tracked or monitored over the long term to determine progress toward these goals. The Implementation Targets and the 10-Year Start List (Appendix C) identifies individual projects to implement the strategies and sub-strategies listed in Section 5. The plan also identifies research needs and information gaps that limit our full understanding of how this steelhead use the systems and what additional or different strategies or projects may be required to meet recovery goals. Taken together these are the components necessary for successfully managing recovery in the East Kitsap DIP.

Taking an adaptive management approach to recovery acknowledges that new information will emerge to inform the prioritization of recovery actions. It also recognizes that waiting to act until all information is gathered is not prudent or acceptable. By articulating the adaptive management process in the plan, the roles and decision-making are clear.

For determining progress, a number of metrics identified in Section 7 can be analyzed and presented at regular intervals, ranging from relatively inexpensive and easy (e.g., the number and type of capital projects completed under each strategy) to more expensive and analytical (e.g., % forest cover – gain and loss).

9.3 Process for Decision-Making

The recovery process is adaptively managed and the best available science is guiding recovery when monitoring and research findings are connected to decision-making. A variety of local and regional partners will likely provide relevant information (Suquamish Tribe, WDFW, NMFS, Puget Sound Salmon

Recovery Council, Wild Fish Conservancy, Long Live the Kings, and others). New findings will be presented directly or summarized through reports and presentations to the Technical Advisory Group (TAG) which will use the information to make specific recommendations to the West Sound Partners for Ecosystem Recovery (WSPER). This approach enables the salmon recovery Lead Entity and the West Central LIO to integrate management, have a common understanding, and adjust the direction of implementation based on monitoring results and lessons learned. Adjusting the direction may include the development of a new strategy, a new prioritization of actions, or a change in sequence to existing actions.

Adaptive management involves assessing indicators associated with project implementation, and the success of land use actions and education and outreach programs in supporting the implementation of recovery strategies. The expectation moving forward is that the Lead Entity will regularly review and report data from monitoring efforts (annually for project implementation and every 5 years for fish and habitat conditions data) to assess the effectiveness of restoration and recovery actions and report to the LIO. The resulting management change or decision may be a formal update to the plan, documentation of a new strategy or policy, change to project selection criteria that accounts for new information, or other less formal methods that ultimately result in more efficient or effective recovery of East Kitsap steelhead.

New or refined goals and implementation targets should be considered and developed as new information is available or after 10-years of plan implementation. Revised goals should be based on best available science, developed by a technical team and refined and vetted by a policy body to approve and implement actions to reach the goals.

An annual or biennial steelhead roundtable where new information on steelhead data and projects are shared and discussed will assist with actively managing recovery of the species and engaging recovery partners. A product from the roundtable can be a brief work plan that is based on the best available science and lessons learned from plan implementation to date, and should be scaled to the local resources available. A work plan will help hold recovery partners accountable and define and track incremental steps forward on the path to steelhead recovery in East Kitsap. The work plan also provides a communication tool between the technical (salmon recovery TAG) and policy bodies (LIO, Tribal Council, etc.) in the East Kitsap DIP and Puget Sound region.

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APPENDIX A

EAST KITSAP STEELHEAD ABUNDANCE ESTIMATES AND POPULATION GOALS MEMO

ESA

5309 Shilshole Avenue, NW
Suite 200
Seattle, WA 98107
206.789.9658 phone
206.789.9684 fax

www.esassoc.com

memorandum

date December 18, 2018 (minor edits to creeks February 21, 2020)

to Steve Todd and Tom Ostrom, Suquamish Tribe

cc Susan O'Neil

from Pete Lawson and Ilon Logan

subject East Kitsap Steelhead Task 3 Memo: Abundance Estimates and Population Goals

Introduction

This memo describes the approach used by the East Kitsap Steelhead project team to develop a population goal for the East Kitsap Demographically Independent Population (DIP) of the Puget Sound Steelhead Distinct Population Segment (DPS). The various methods include the regional abundance and productivity targets developed by the Puget Sound Steelhead Recovery Team (PSSRT) and National Marine Fisheries Service (NMFS) and a new method relating habitat and smolt production, which utilizes empirical data from nearby Puget Sound Lowland streams, as such data for East Kitsap DIP streams is lacking. The Suquamish Tribe seeks a data-driven and defensible population goal for steelhead. As described in this memo, the examination of multiple lines of evidence, which all yield ranges of East Kitsap DIP adult steelhead population goals that are similar and overlap, verifies the robust nature of the analysis.

Population Goals as Ranges

Steelhead recovery can be achieved through a variety of population structures and dynamic scenarios, all of which can support a healthy, self-sustaining DIP population. This memo emphasizes the importance of setting population goals as a range, versus a single number, to represent the density dependent relationship between steelhead productivity and number of adult spawners. Since abundance and productivity (recruits per spawner) both drive viability of a population, it is useful to set recovery goals as a range of paired abundance and productivity values with the 70% of historic estimate at the upper end of the abundance range, paired with a low (replacement) productivity value. Furthermore, lower abundances consistent with recovery are paired with higher productivity values.

Relationship between Marine Survival Rates and Population Goals

Inherent in this goal setting approach is the explicit recognition that productivity can be represented by the survival ratio of outmigrating smolts to returning adult fish, as expressed in a smolt to adult survival ratio (SAR). The use of SAR rates in population goal setting includes assumptions about the marine survival of outmigrating fish. Within the East Kitsap steelhead DIP, marine survival is primarily driven by early marine survival in Puget Sound as smolts leave their natal rivers and migrate to the ocean. Early marine survival rates for Puget Sound steelhead have been lower than other DPSs in the Pacific Northwest and have shown less variation (LLTK, 2018). In recent years, some Puget Sound and Hood Canal rivers have measured early marine survival rates as low as 1 percent (Moore et al. 2015). If this trend continues unabated, the resulting SAR numbers mean recovery of the species would be difficult or impossible. These facts emphasize the importance of acknowledging the role of productivity in recovery, but also underscore the critical importance of larger-scale regional efforts to understand the causes of low early marine survival in Puget Sound and to address these causes.

Regional Methods for Establishing Steelhead Population Goals

Between 2015 and 2018, tribal and state co-managers (Northwest Indian Fisheries Commission [NWIFC] and Washington Department of Fish and Wildlife [WDFW]) developed a regional approach to setting DIP-level population goals. The details of this approach are included in Attachment 2 of the recently released draft Proposed Puget Sound Steelhead Recovery Plan (PSSRT, 2018). In short, the regional approach was based on NMFS estimates of historical steelhead abundance for each of the 32 Puget Sound steelhead DIPs. Following the policy precedent established with Puget Sound Chinook salmon, recovery goals were set at 70% of the estimated historical steelhead abundance with the assumption that if these abundance levels were achieved within the Puget Sound DIPs, it would equate to viable populations of steelhead. Relevant details of the regional methods applied to the East Kitsap DIP are described in the following two sections.

Historic Commercial Catch Records (Hard and Gayeski Methods)

NMFS used estimates of historical abundance based on commercial catch records of Puget Sound steelhead from 1895, as described in U.S. Commission of Fish and Fisheries reports. Hard et al. (2007) and Gayeski et al. (2011) each utilized the catch data to estimate total historic steelhead run size. Gayeski et al. (2011) used Bayesian analysis to estimate the total Puget Sound steelhead abundance in 1895 as 621,700 (90% CI of between 485,000 and 930,000), assuming a 41-68% harvest rate (higher in Nooksack basin and lower in Skagit basin), a fish size of between 7 and 9.5 pounds per fish, and an assumed unreported catch rate of between 10 and 100 percent, depending on location. Hard et al. (2007) estimated a total Puget Sound steelhead abundance in 1895 as 436,790 fish (range of 327,592 and 545,987), assuming a slightly lower harvest rate (30-50%), a larger fish size of 12 pounds per fish, and an assumed unreported catch rate of zero.

For purposes of setting DPS-wide recovery goals, PSSRT opted to use a historic abundance estimate of 436,790, as estimated by Hard et al. (2007), and apply 70% of this estimated abundance (305,922) as the abundance goal for Puget Sound steelhead recovery. In order to develop population goals for the individual DIPs, PSSRT allocated the DPS-wide abundance goal based on proportional habitat availability (stream length), based on the NOAA intrinsic potential model with modifications based on input from local biologists. Using these methods, the East Kitsap DIP was assumed to contain 188 km of steelhead habitat, representing 2.8% of the steelhead habitat (expressed as stream length) in the Puget Sound DPS (6,600 km). Applying this ratio to the overall estimated historic population, the historic steelhead abundance of the East Kitsap DIP is 12,400 adult returns, equating to a recovery goal of 8,700 adult returns (70% of historic abundance).

As noted previously, recovery goals are best described as a range of paired abundance and productivity values where the upper end of abundance values is paired with low productivity values, and vice versa. These combinations were assessed using two stock recruit models: the Beverton-Holt and Ricker curves. Results of the modeling indicate that abundance goals for recovery range from 2,600 to 8,700 using the Beverton-Holt stock recruit curve and a productivity assumption of 1.0 recruits (returning adults) per spawner for the higher abundance estimate and a productivity assumption of 2.3 recruits per spawner for the lower abundance estimate. Figure 1 represents a graphical depiction of the stock recruit curve. Likewise, the abundance goals using the Ricker stock recruit curve range from 3,600 to 8,700 with a productivity assumption of 1.0 recruits (returning adults) per spawner for the higher abundance estimate and a productivity assumption of 2.1 recruits per spawner for the lower abundance estimate.

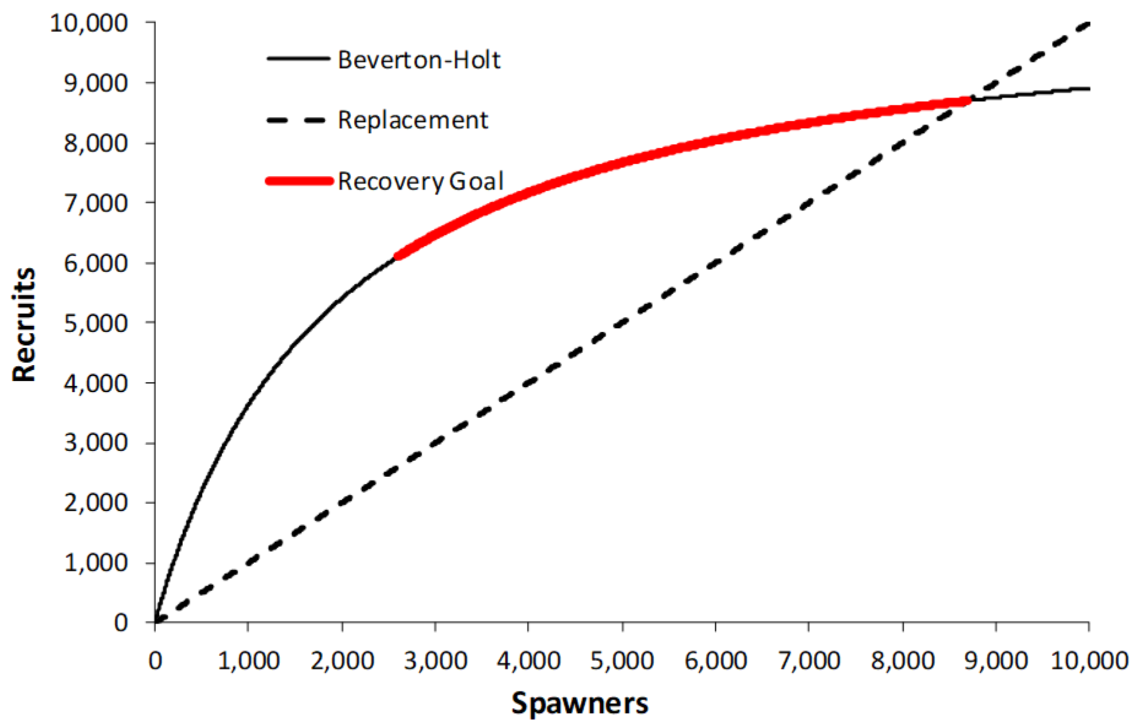

Figure 1. East Kitsap DIP Steelhead Recovery Goal as a Beverton - Holt Productivity Curve (Anderson, 2018)

Intrinsic Potential of Historic Habitat (Myers Method)

Myers et al. (2015) used somewhat different methods to estimate historical populations of steelhead within the Puget Sound DPS that combines historical habitat availability and estimates of productivity per unit measure. Habitat availability was analyzed using existing intrinsic potential (IP) mapping for steelhead, based on consideration of the Interior Columbia TRT's IP model and on expert opinion. The stream habitat rating matrix was used to assign steelhead intrinsic potential to applicable stream reaches, based on the combination of stream gradient and bankfull width (Table 1). For the purposes of historical abundance estimates, only those stream reaches classified as either "high" or "moderate" intrinsic potential were used.

Table 1. Stream Habitat Rating Matrix (Below Natural Barriers) for Puget Sound Steelhead (from Meyers et al. 2015)

Stream gradient (percent)	Bankfull Width		
	0–3 m	**3–20 m**	**>20 m**
0.0–0.25	High	Moderate	Low
0.25–4.0	Moderate	High	Moderate
>4.0	Low	Low	Low

Using these methods, the East Kitsap DIP was assumed to contain 188 km of steelhead habitat (same stream length mentioned above and used in Hard et al. method), which represents an areal estimate of 677,200 m^2 of "moderate" and "high" stream habitat. This represents approximately 0.5 % of the total "moderate" and "high" habitat within the Puget Sound DPS. The useable habitat area was then combined with estimated steelhead productivity. Smolt to adult return rates were then applied to estimate historical spawner abundance.

Myers et al. (2015) calculated a level of steelhead productivity (0.023 smolts/m^2) based on an average of steelhead parr freshwater productivity for steelhead in western Washington and Puget Sound as estimated by Chapman (1981), Gibbons et al. (1985), and the U.S. Army Corps of Engineers (1988), coupled with a parr-to-smolt survival assumption of 0.3 (Chapman, et al., 1981). Using these methods, Myers et al. (2015) estimated historical steelhead smolt production within the East Kitsap DIP as 15,575. Applying a smolt to adult survival rate of 10% produces a historical spawner abundance of 1,557 adult returns, whereas applying a higher survival rate of 20% produces an estimate of 3,115 adult returns.

A summary of existing estimates of historical steelhead abundance in the Puget Sound DPS and East Kitsap DIP, as well as potential restoration goals for abundance/productivity under the scenarios discussed above is presented as Table 2. Note that the range represented by the various methods is from 2,200 to 12,000 spawners, and where the goals are presented as a combination of productivity and abundance, the ranges generally overlap.

Table 2. Summary of Multiple Methods for Estimating Historical Steelhead Populations and Proposed Recovery Goals for the East Kitsap Steelhead DIP

	Historical Abundance Estimates			Recovery Goal Estimates			
Historical DPS Abundance Estimate Method and Source	**Historical Steelhead Abundance for Puget Sound DPS**	**East Kitsap Abundance Method**	**Historic Steelhead Abundance Estimate for East Kitsap DIP**	**Puget Sound DPS Recovery Goal[h]**	**East Kitsap DPS Recovery Goal[h]**	**Stock Recruit Curve to Assess Abundance to Productivity Relationship**	**East Kitsap DIP Abundance Goals With Associated Productivity/ Smolt Survival Goals**
Historic Catch Data (Hard et al. 2007)[a]	436,790	PSSRT (2018) [c]	12,442[e]	305,753	8,709	Beverton-Holt Curve	2,600 (with R/S = 2.3) to 8,700 (with R/S =1)
	436,790	PSSRT (2018) [c]	12,442[e]	305,753	8,709	Ricker Curve	3,600 (with R/S = 2.1) to 8,700 (with R/S =1)
	327,592 - 545,987[c]	Myers et al. 2015[d]	1,663 - 2,770[f]	229,314 – 382,191	1,164 – 1,939 (1,557)	N/A	2,300 – 3,900 (With 5% SAS)
Historic Catch Data (Gayeski, et al. 2011) [a]	621,700	PSSRT (2018) [c]	17,709[e]	435,190	12,396	Beverton-Holt Curve	12,400 (with R/S =1)
	621,700	PSSRT (2018) [c]	17,709[e]	435,190	12,396	Ricker Curve	12,400 (with R/S =1)
	485,100 - 929,700[d]	Myers et al. 2015[d]	2,462 – 4,718[f]	338,870 – 650,790	1,723 – 3,302 (2,512)	N/A	3,400 – 6,600 (With 5% SAS)
Habitat Availability (Myers et al. 2015)[b]	306,800 - 613,661[a]	Myers et al. 2015[d]	1,557 - 3,115[f,g]	214,760 - 429,520	1,090 - 2,181[g]	N/A	2,200 – 4,400 (With 5% SAS)

[a] Estimate of historic steelhead abundance based on historic catch records.

[b] Meyers et al. (2015) estimate of abundance based on historic habitat availability (steelhead intrinsic potential stream kilometers) and an estimate of smolt production per unit area, with smolt production from individual DIPs summed, and two historic smolt-to-adult survival ratios applied (10% and 20%).

[c] Range of historical estimate for Puget Sound DPS steelhead abundance in Hard et al. (2007).

[d] Range of historical estimate for Puget Sound DPS steelhead abundance in M Gayeski, et al. (2011).

[e] Estimate of contribution of East Kitsap steelhead DIP historical abundance to PS DPS abundance is based on ratio of historically available habitat. Calculation that East Kitsap DPS provided approximately 2.85% of overall steelhead abundance in the DPS.

[f] Estimate of abundance for the East Kitsap DIP based on historic habitat availability in the DIP (steelhead medium and high intrinsic potential stream kilometers) and an estimate of smolt production per unit area.

[g] Range of abundance estimate and recovery goals are based on a SAS of 10% and 20%, respectively.

[h] Recovery goal set at 70% of estimated historic abundance

Potential Limitations of Regional Methods

The PSSRT (NMFS, 2018) notes that the above methods may overestimate the historical steelhead abundance of populations composed of many small independent streams relative to those in larger rivers. This may be particularly true for the NMFS methods, which estimates historical habitat availability using methods that weight all streams equally, irrespective of habitat attributes such as stream size or gradient. Populations that are composed of many independent streams covering a large geographic area yielded large estimates of total linear stream kilometer, but these streams may not have been of sufficient size and habitat quality to support highly abundant steelhead populations, such as those found in the East Kitsap DIP area. Other notable examples of such systems in the Puget Sound DPS include the North Lake Washington, South Puget Sound, Strait of Juan de Fuca, Discovery Bay, East Hood Canal, West Hood Canal, and South Hood Canal DIPs.

The PSSRT estimates that the streams within the East Kitsap DIP supported approximately 2.8% of overall steelhead abundance in the Puget Sound DPS. In comparison, Myers et al. (2015), assessed stream gradient and width, to provide a coarse-scale estimate of habitat suitability for steelhead spawning, and estimated that the streams of the East Kitsap DIP contributed approximately 0.5% of the overall steelhead abundance within the DPS. In both cases, the stream distance assigned to the East Kitsap DIP was 188km.

Local Method for Establishing East Kitsap DIP Population Goals

In order to address some of the limitations in the methods discussed above, the Tribe sought to utilize existing data on steelhead productivity (including SAR) and abundance for streams within the East Kitsap DIP. Unfortunately, steelhead runs in East Kitsap DIP streams are currently comprised of a relatively small number of spawning adults and little data exist on current and historic use of the majority of the drainages in the DIP. Likewise, no escapement monitoring has been conducted and no escapement goals have been established. The Synthesis Report (ESA, 2018) presents more discussion of steelhead data gaps in the East Kitsap DIP.

Therefore, we investigated whether productivity data existed for analogous drainages in Puget Sound, which were comparable to at least some of the drainages in East Kitsap. Two drainages, Big Beef Creek and Snow Creek, were identified as appropriate analogous drainages to compare steelhead populations. Big Beef Creek is located on the Kitsap Peninsula immediately west of East Kitsap and drains to Hood Canal; Snow Creek is on the Olympic Peninsula to the northwest and drains to Discovery Bay. Both drainages support native (wild) runs of steelhead and both are rain-driven systems of comparable basin size. Furthermore, they have comparable hydrologic regimes with the major steelhead drainages in the East Kitsap DIP (Table 3). Based on this comparison, and in discussion with WDFW, NMFS, and fishery co-managers, Big Beef and Snow Creeks were selected as appropriate drainages for estimation of steelhead productivity.

Table 3. Comparison of Characteristics for Big Beef and Snow Creeks with the Major Steelhead Stream Drainages in the East Kitsap DIP

Stream	Watershed Area (acres)	Stream Miles -Total	Mainstem Stream Miles	Annual Peak Flow (cfs)	Annual Low Flow (cfs)
Big Beef	8,960 (approx)	35.0	11.0	300-400	0.2 - 1
Snow Creek	14,395	30.0	10.1	100-300	0.7 - 3
Chico Creek	11,033	57.0	6.0	300-900	1
Curley Creek	9,099	32.4	5.3	300	2
Blackjack Creek	8,626	36.2	6.9	130 -600	2-5
Gorst Creek	6,133	30.6	3.9	30-120	5 - 10

In addition to similarities in basin size and hydrologic regime, there is 37 years of data on juvenile escapement from smolt-traps operated at the mouths of each stream. Data from WDFW on Big Beef Creek and Snow Creek smolt abundance per year, as well as calculated smolt densities (expressed as smolts/mile and calculated from length of steelhead occupied river miles) are presented in Appendices A and B, respectively. The relevant smolt density data for both streams is summarized in Table 4. In addition to smolt abundance, the steelhead SAR for these two drainages has been calculated over various time periods (Table 5).

Table 4. Summary of Steelhead Smolt Data for Big Beef and Snow Creeks.

Parameter	Big Beef Creek (6.9 stream miles of occupied habitat)	Snow Creek (8.5 stream miles of occupied habitat)
Number of Years of Data	37	36
Average Smolt Density (Std Dev)	184 (59)/mile	158 (81)/mile
Maximum Smolt Density	317	326
Maximum Smolt Density	45	28
Average of 5 Highest Years	278	288
Average of 10 Highest Years	257	263

Table 5. Puget Sound Steelhead Smolt to Adult Return (SAR) rates - From Kendall et al. 2017

Run Description	Years	Smolt to Adult Return Rate	
		Geometric mean	SE
Big Beef Creek winter-run wild	2005-2006	3.06%	1.76%
Big Beef Creek winter-run wild	2007-2012	1.92%	1.90%
Nisqually River winter-run wild	2009-2012	0.79%	0.61%
Snow Creek winter-run wild	1978-1986	6.02%	1.04%
Snow Creek winter-run wild	1987-1996	2.98%	1.56%
Snow Creek winter-run wild	1997-2000	4.88%	4.16%
Snow Creek winter-run wild	2001-2006	1.61%	0.74%
Snow Creek winter-run wild	2007-2012	2.98%	0.72%

The data show substantial variability in smolt densities over time, reflecting natural population variability (Table 4). Although average smolt density over the time of record for Big Beef and Snow Creek were 184 and 158, respectively, the highest smolt densities in both drainages were around 320 fish. In addition, when assessing the highest 5-year and 10-year averages, smolt densities range from about 260 to 290 smolts per mile. In order to assess the potential for adult abundance in the East Kitsap DIP, smolt densities on the higher end of the range (250 to 350 smolts/mile) observed in Snow and Big Beef Creeks were selected, in recognition of the restoration actions resulting in increased densities due to improvement of stream habitat quality.

Likewise, measured SAR rates in Big Beef and Snow Creeks also varied over time (Table 5). Big Beef Creek averaged between two and three percent over an eight-year period, while Snow Creek was more variable over a 33-year period, with SARs from a low of 1.6 percent to a high of 6 percent. To some degree, the variability is due to fluctuations in Puget Sound early marine survival. In order to assess the potential for adult abundance in the East Kitsap DIP, a variety of SAR rates were applied, using the available data. For illustrative purposes, SAR rates ranging from 0.02 to 0.10 were selected. A SAR of 0.02 sustained over time would likely not support a self-sustaining population and a SAR rate of 0.10 is likely more indicative of historical conditions, and not likely achievable due to the number and magnitude of current day threats and pressures, including substantial habitat degradation and loss, and larger-scale ecological alterations to ocean conditions from climatic processes.

Based on the data above, a range of smolt production and SAR data can be applied to East Kitsap drainages to estimate a number of steelhead spawners based on length of steelhead habitat. The project team estimated historic steelhead habitat by overlaying the PSSRT historic steelhead layer and the current NWIFC steelhead distribution layer in GIS. Biologists with the Suquamish Tribe Fisheries Department then reviewed and edited these layers, based on their local knowledge and best professional judgement on where steelhead were historically distributed. This process resulted in some additions to the extent of the preliminary GIS layers. In total, 233 km (144.8 miles) of historic steelhead habitat were identified in the whole of the East Kitsap DIP (Figure 3). The use of historic habitat to estimate recovery potential is appropriate because a primary goal of the recovery plan is to restore access to habitat where steelhead are currently precluded or constrained.

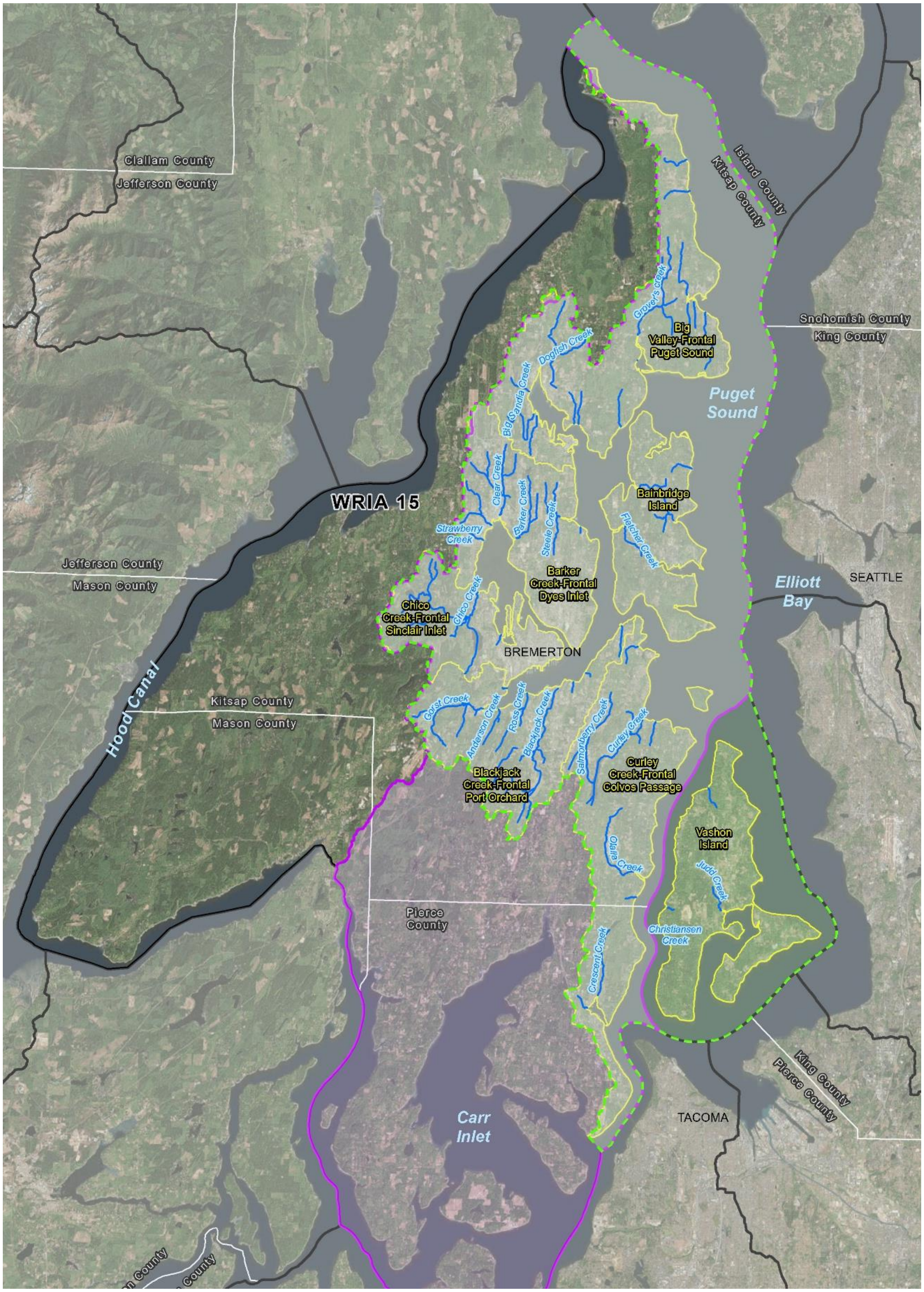

Figure 2. East Kitsap DIP Estimated Historic Steelhead Distribution

Applying the methods and the range of the smolt abundance and SAR assumptions described above, Table 6 displays goals for returning spawners in each of the seven individual sub-watersheds of the East Kitsap DIP (Figure 2 shows the seven sub-watersheds). For example, the Chico Creek-Frontal Sinclair Inlet would have an abundance goal of between 120 and 340 adult spawners.

Table 6. Range of Steelhead Spawner Recovery Goals Based on Smolt Density and SAR Assumptions Applied to Individual Sub-Watersheds

East Kitsap DIP Sub-Watersheds	Historic East Kitsap Steelhead Stream Miles	Percent of Total Historic East Kitsap Steelhead Stream Miles	Returning Spawner Goals Under Various Density and SAR Assumptions		
			250 smolts/ mile	300 smolts/ mile	350 smolts/ mile
			0.03 SAR	0.05 SAR	0.06 SAR
Bainbridge Island	7.4	5.1%	56	112	156
*Barker Creek-Frontal Dyes Inlet	24.3	16.8%	182	364	510
*Big Valley-Frontal Puget Sound	37.4	25.8%	280	561	785
*Blackjack Creek-Frontal Port Orchard	32.0	22.1%	240	481	673
Chico Creek-Frontal Sinclair Inlet	16.0	11.0%	120	240	336
Curley Creek-Frontal Colvos Passage	25.1	17.3%	188	376	526
Vashon Island	2.6	1.8%	20	40	55
Total	**144.8**	**100.0**%	**1,086**	**2,174**	**3,041**

*These three subbasins combined represent a 65% of historic steelhead habitat

It is also useful to apply these methods to "priority drainages", both grouped and individually, to determine where steelhead recovery actions are most needed. Priority drainages of the East Kitsap DIP have been grouped into three tiers by the project team as shown in Table 7.

Table 7. Hierarchical Organization of East Kitsap DIP Sub-watersheds and Priority Drainages

ubwatershed	Drainages by Tier
Big Valley – Dogfish	Tier 1: Grovers
	Tier 2: Dogfish, Big Scandia
	Tier 3: Carpenter, Doe-Kag-Wats, Lemolo, Thompson, Bliss, Cowling
Barker – Dyes	Tier 1: Clear
	Tier 2: Barker, Steele, Strawberry
	Tier 3: n/a
Bainbridge Island	Tier 1: n/a
	Tier 2: n/a
	Tier 3: Springbrook/Fletcher, Issei
Chico-Frontal Sinclair	Tier 1: Chico
	Tier 2: n/a
	Tier 3: n/a
Blackjack	Tier 1: Blackjack, Gorst
	Tier 2: Ross
	Tier 3: Anderson, Baileys, Karcher/Annapolis
Curley-Colvos	Tier 1: Curley/Salmonberry
	Tier 2: Olalla, Crescent
	Tier 3: North/Donkey, North Fork Olalla
Vashon Island	Tier 1: n/a
	Tier 2: n/a
	Tier 3: Judd, Christensen

Table 8 below analyzes adult steelhead abundance for summed drainages in priority Tiers 1 through 3, again using the selected range of smolt abundance and SAR assumptions. This analysis shows the six Tier 1 drainages would have a spawner abundance of between 500 and 1,500, representing approximately half of the production in the East Kitsap DIP. Attachment 3 presents the range of results applied to individual drainages in Tiers 1 through 3.

Table 8. Range of Steelhead Spawner Recovery Goals Based on Smolt Density and SAR Assumptions Applied to Priority Drainages (Tier 1 through 3) and Non- Priority Drainages

Drainage Tiers (by Priority)	Historic EK SH Stream Miles	Percent of All EK Historic SH Stream Miles	Returning Spawner Goals Under Various Density and SAR Assumptions		
			250 smolts/ mile	300 smolts/ mile	350 smolts/ mile
			0.03 SAR	0.05 SAR	0.06 SAR
Tier 1 Drainages	69.88	48.3	524	1,048	1,467
Tier 2 Drainages	35.97	24.8	270	539	755
Tier 3 Drainages	12.73	8.8	95	191	267

Non-Tiered Drainages	26.25	18.1	197	394	551
Total	**119**	**100.0**	**1,086**	**2,172**	**3,041**

Applying the range of productivity and SARs discussed above to the entire DIP, the DIP-wide returning steelhead spawner numbers were calculated (Table 8). Within the range of variables presented, adult returns range from approximately 700 to 5,000. However, as mentioned previously, the lowest SAR rate (0.02) would not likely support recovery, and the highest SAR rate (0.10) may not be achievable over a sustained period. Therefore, to inform steelhead population recovery goals, adult abundance was assessed with SAR numbers ranging between 0.03 and 0.06. The combination of these SAR numbers and smolt densities between 250 and 350 smolts/mile equate to an abundance number of between 1,086 and 3,041 adult fish, as shown by the bold italicized numbers in Table 8.

Table 9. East Kitsap DIP Calculated Spawner Densities Using a Range of Smolt Productivities and SARs

Modeled Steelhead Smolt Production Per Stream Mile	Modeled Smolt to Adult Return Rate					
	0.02	**0.03**	**0.04**	**0.05**	**0.06**	**0.10**
250	724	***1,086***	***1,448***	***1,810***	***2,172***	3,621
275	797	***1,195***	***1,593***	***1,991***	***2,390***	3,983
300	869	***1,303***	***1,738***	***2,172***	***2,607***	4,345
325	941	***1,412***	***1,883***	***2,353***	***2,824***	4,707
350	1,014	***1,521***	***2,028***	***2,534***	***3,041***	5,069

The results of this approach can be applied as a range of steelhead population abundance goals in the East Kitsap DIP. The range of between 1,000 and 3,000 spawners is generally consistent with previous regional population estimates and goals and overlaps the lower end of the population ranges developed through those methods. The advantages of this approach are that it utilizes actual steelhead life-cycle data (albeit in comparable drainages outside of the DIP) while relying on expert knowledge regarding the potential extent of steelhead freshwater habitat distribution in the DIP if recovery actions are completed.

It is also useful, both to provide a validation on the proposed adult abundance numbers, and to focus where restoration actions will provide the greatest benefit, to apply the results of the approach to smaller geographic units, including sub-watersheds and individual priority drainages. Pacific salmonids such as steelhead are generally recognized to have some degree of metapopulation structure at the DPS scale. The distribution of steelhead at smaller scales, such as the DIP scale, may also function in a similar manner, providing source and sink sub-populations. Within the East Kitsap DIP, the current steelhead distribution appears to be somewhat patchy.

The six Tier 1 streams within the East Kitsap DIP contain a very high proportion of quality steelhead habitat and represent the majority of current steelhead distribution. Historically, these larger streams may have acted as “strongholds” for the metapopulation, demonstrating relatively stable levels of abundance and high productivity. These streams may have also provided genetic diversity to supplement sub-populations in other smaller streams in the DIP, which have more limited amounts of available habitat and are therefore potentially susceptible to natural disturbance (and human pressures) and resultant physical and biotic disruptions.

However, it should be noted that although the importance of a metapopulation source can often be related to the size of the metapopulation, the position of the source relative to other populations can also be important for conserving connectivity. Therefore, steelhead recovery planning will address increasing abundance and productivity throughout the DIP, including the northern and southern portions where smaller streams predominate. Likewise, investigation of steelhead genetics and population structure within the entire DIP is needed to guide effective restoration efforts.

Summary and Conclusions

The project team evaluated multiple methods for setting population goals for recovery of East Kitsap DIP steelhead including previous DIP-level population goals developed for regional efforts. In order to address limitations in the regional approaches that likely result in overestimated historic populations based on the nature of East Kitsap DIP streams (smaller, rain dominated lowland stream systems), we used productivity data from analogous drainages to estimate production potential in the East Kitsap DIP. This analysis supports a steelhead population goal in the East Kitsap DIP with abundances ranging from about 1,000 to 3,000 spawners, which is a variable number linked to the productivity of the system. This proposed goal range is within the lower end of the population goal range proposed for the East Kitsap DIP by PSSRT for the regional goal setting (NMFS, 2018).

The population goal of 1,000 to 3,000 spawners also explicitly recognizes the key relationship between productivity and abundance. This is illustrated by Figure 3, which demonstrates a number of productivity curves with a spawner abundance set at 3,000 and various SARs. Note that at a lower SAR, recovery requires significantly more spawners (approximately 1,200). The curve also demonstrates that a higher SAR lowers the number of required spawners (840 fish at the low end of the curve at a 0.06 SAR). This concept is extremely important in setting appropriate recovery goals, and as previously discussed, reemphasizes the importance of early marine survival in Puget Sound in directly affecting steelhead recovery.

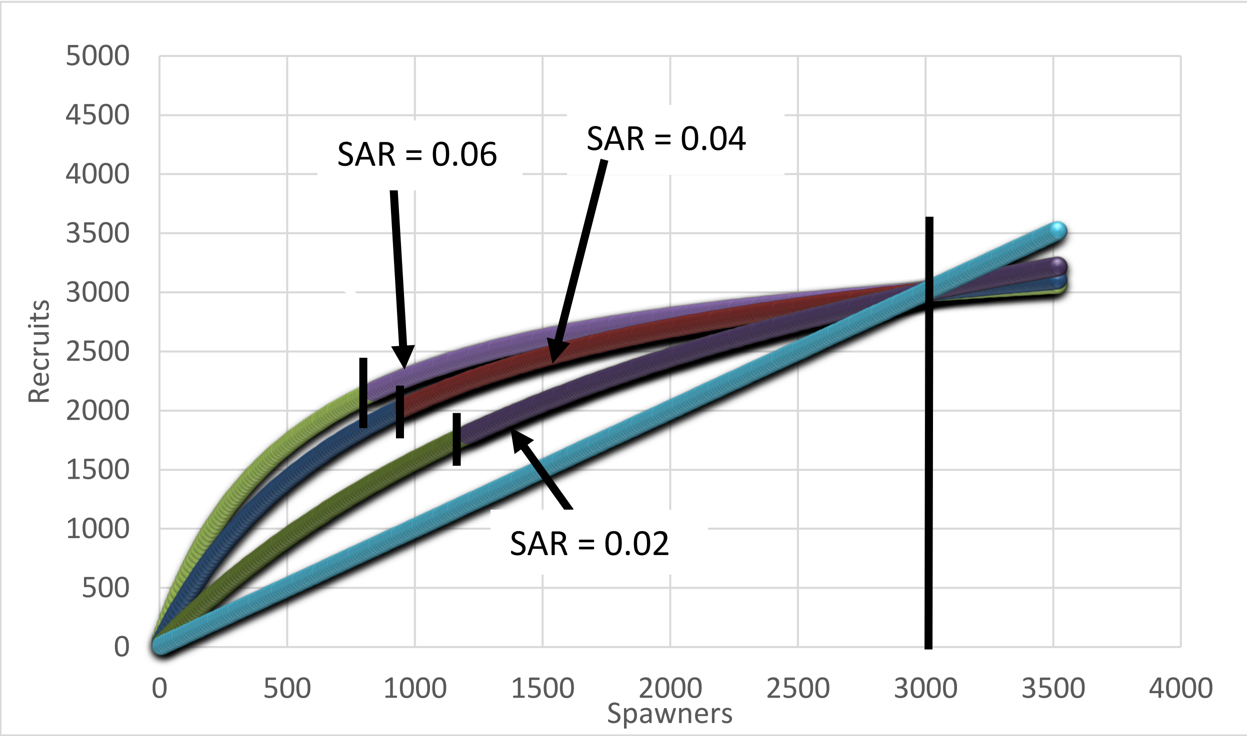

Figure 3. Modeled Productivity Curve with Constant Spawner Abundance (S0 = 3,000) and Varying SAR

The population goal of 1,000 to 3,000 spawning steelhead in the East Kitsap DIP should be adaptively managed, as data on productivity and abundance for drainages in the DIP is collected. This information is crucial for analyzing goal success, as even robust spawner abundance numbers in the absence of DIP-specific productivity estimates will not allow for an assessment of the population recovery status or trajectory. Additional data that help describe viable salmonid population (VSP) parameters such as life history diversity, spatial structure, and genetics should also be researched and/or collected. Collection of DIP-specific data is key for applying adaptive management during the recovery process and for assessing recovery status of the species in the East Kitsap DIP.

Note: Per comments from Suquamish Tribe and review of final maps, Cowling Creek was added as a Tier 3 drainage but no spawners were assigned and no change was made to the population calculations. Additionally, Tier 3 creek names in Attachment 3 were corrected.

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Attachments

Attachment 1. WDFW Smolt Trap Data from Big Beef Creek (1978-2014)

Region Name	Watershed	Trap Location	Migration Year	Species	Occupied River Miles	Abundance	Density	Contact
Hood Canal	Big Beef Creek	Big Beef Creek	1978	Steelhead	6.9	881	128	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1979	Steelhead	6.9	870	126	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1980	Steelhead	6.9	1,685	244	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1981	Steelhead	6.9	1,578	229	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1982	Steelhead	6.9	1,269	184	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1983	Steelhead	6.9	1,237	179	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1984	Steelhead	6.9	1,770	257	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1985	Steelhead	6.9	1,189	172	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1986	Steelhead	6.9	1,210	175	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1987	Steelhead	6.9	1,153	167	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1988	Steelhead	6.9	990	143	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1989	Steelhead	6.9	1,284	186	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1990	Steelhead	6.9	1,597	231	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1991	Steelhead	6.9	1,089	158	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1992	Steelhead	6.9	1,595	231	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1993	Steelhead	6.9	1,181	171	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1994	Steelhead	6.9	1,614	234	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1995	Steelhead	6.9	1,311	190	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1996	Steelhead	6.9	1,436	208	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1997	Steelhead	6.9	1,351	196	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1998	Steelhead	6.9	1,551	225	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	1999	Steelhead	6.9	1,776	257	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2000	Steelhead	6.9	1,316	191	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2001	Steelhead	6.9	1,932	280	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2002	Steelhead	6.9	2,191	317	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2003	Steelhead	6.9	1,261	183	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2004	Steelhead	6.9	1,939	281	Clayton Kinsel

Region Name	Watershed	Trap Location	Migration Year	Species	Occupied River Miles	Abundance	Density	Contact
Hood Canal	Big Beef Creek	Big Beef Creek	2005	Steelhead	6.9	1,664	241	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2006	Steelhead	6.9	964	140	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2007	Steelhead	6.9	913	132	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2008	Steelhead	6.9	925	134	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2009	Steelhead	6.9	1,005	146	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2010	Steelhead	6.9	706	102	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2011	Steelhead	6.9	311	45	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2012	Steelhead	6.9	716	89	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2013	Steelhead	6.9	1,164	144	Clayton Kinsel
Hood Canal	Big Beef Creek	Big Beef Creek	2014	Steelhead	6.9	816	101	Clayton Kinsel

Attachment 2. WDFW Smolt Trap Data from Snow Creek (1978-2014)

Region Name	Watershed	Trap Location	Migration Year	Species	Occupied River Miles	Abundance	Density	Contact
Hood Canal	Snow Creek	Snow Creek	1978	Steelhead	8.54	1,510	177	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1979	Steelhead	8.54	960	112	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1980	Steelhead	8.54	1,461	171	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1981	Steelhead	8.54	1,659	194	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1982	Steelhead	8.54	1,866	218	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1983	Steelhead	8.54	1,367	160	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1984	Steelhead	8.54	1,192	140	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1985	Steelhead	8.54	2,233	261	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1986	Steelhead	8.54	557	65	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1987	Steelhead	8.54	2,003	235	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1988	Steelhead	8.54	582	68	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1989	Steelhead	8.54	1,844	216	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1990	Steelhead	8.54	1,438	168	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1991	Steelhead	8.54	1,251	146	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1992	Steelhead	8.54	2,238	262	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1993	Steelhead	8.54	1,629	191	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1994	Steelhead	8.54	1,704	200	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1995	Steelhead	8.54	320	37	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1996	Steelhead	8.54	2,169	254	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1997	Steelhead	8.54	1,253	147	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1998	Steelhead	8.54	838	98	Mark Downen
Hood Canal	Snow Creek	Snow Creek	1999	Steelhead	8.54			Mark Downen
Hood Canal	Snow Creek	Snow Creek	2000	Steelhead	8.54	1,383	162	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2001	Steelhead	8.54	2,526	296	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2002	Steelhead	8.54	2,474	290	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2003	Steelhead	8.54	2,787	326	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2004	Steelhead	8.54	565	66	Mark Downen

Region Name	Watershed	Trap Location	Migration Year	Species	Occupied River Miles	Abundance	Density	Contact
Hood Canal	Snow Creek	Snow Creek	2005	Steelhead	8.54	1,187	139	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2006	Steelhead	8.54	711	83	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2007	Steelhead	8.54	990	116	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2008	Steelhead	8.54	298	35	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2009	Steelhead	8.54	441	52	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2010	Steelhead	8.54	870	102	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2011	Steelhead	8.54	944	111	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2012	Steelhead	8.54	242	28	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2013	Steelhead	8.54	2,279	267	Mark Downen
Hood Canal	Snow Creek	Snow Creek	2014	Steelhead	8.54	864	101	Mark Downen

Attachment 3. Steelhead Spawner Recovery Goals (by Drainage) in Tier 1 Through 3 Sub-watersheds

Priority Drainages by Tier (1 through 3) Priority Drainages	Historic EK SH Stream Miles	Returning Spawner Goals Under Various Density and SAR Assumptions		
		250 smolts/ mile 0.03 SAR	300 smolts/ mile 0.05 SAR	350 smolts/ mile 0.06 SAR
Tier 1 Sub-watersheds				
Chico Creek DNR#150229 Stream#259 LLID# 1227034476023	15.50	116	232	325
Blackjack Creek DNR#150203 Stream#279 LLID# 1226259475427	15.57	117	234	327
Curley Creek DNR#150188 Stream#294 LLID# 1225461475198	13.73	103	206	288
Grovers Creek DNR# 15.0299 Stream#192 LLID# 1225578477701	8.77	66	132	184
Clear Creek DNR#150249 Stream#246 LLID# 1226843476506	8.53	64	128	179
Gorst Creek DNR#150221 Stream#268 LLID# 1226963475279	7.78	58	117	163
Tier 2 Sub-watersheds				
Dogfish Creek DNR#150285 Stream#207 LLID# 1226499477500	7.01	53	105	147
Steel(e) Creek (Crouch Creek) DNR#150273 Stream#223 LLID# 1226172476511	5.49	41	82	115
Barker Creek DNR#150255 Stream#245 LLID# 1226705476368	4.78	36	72	100
Olalla Creek DNR#150107 Stream#313 LLID#1225410474211	4.29	32	64	90
Ross Creek DNR#150209 Stream#275 LLID# 1226551475388	3.96	30	59	83
Strawberry Creek DNR#150246 Stream#248 LLID# 1226922476460	3.77	28	57	79
Big Scandia Creek DNR #150280 Stream#213 / LLID# 1226552477178	3.56	27	53	75
Crescent Creek DNR#15.0099 Stream#321 LLID#1225810473466	3.11	23	47	65
Tier 3 Sub-watersheds				
Carpenter Creek (Lake Outlet) DNR_Stream#150309 Stream#181 LLID# 1225106477947	2.74	21	41	58
Anderson Creek (Gorst) DNR# 15.0211 Stream#272 LLID# 1226818475280	2.05	15	31	43

		Returning Spawner Goals Under Various Density and SAR Assumptions		
Priority Drainages by Tier (1 through 3) Priority Drainages	Historic EK SH Stream Miles	250 smolts/ mile 0.03 SAR	300 smolts/ mile 0.05 SAR	350 smolts/ mile 0.06 SAR
Thompson Creek /Kleabel Cr DNR#15.0296 Stream#198 LLID#1225722477108	1.76	13	26	37
Springbrook / Fletcher Creek DNR# 150341 Stream#461 LLID# 1225663476464	1.70	13	25	36
Lemolo Creek DNR#15.0291 Stream# / LLID#1226123477121	1.49	11	22	31
Doe-Kag-Wats Estuary Creek DNR Stream #185 / LLID# 1224871477652)	1.17	9	18	25
North Creek/Donkey Creek DNR#150097 Stream#322 LLID# 1225911473375	0.78	6	12	16
Karcher / Annapolis Creek DNR#150201 Stream#282 LLID# 1226114475472	0.49	4	7	10
North Fork Olalla Creek DNR#150108 Stream# LLID# 1225506474256	0.30	2	5	6
Baileys Creek DNR#15.0215 Stream#270 LLID#1226919475271	0.21	2	3	5
Issei Creek DNR# 15.0341 Stream#461 LLID# 1225661476471	0.02	0	0	0
Bliss Creek (Stream #195 LLID#1225577477541)	0.01	0	0	0
TOTAL OF TIER 1-3 WATERSHEDS	**119**	**889**	**1,779**	**2,490**

Note: Cowling Creek is considered a Tier 3 drainage by the Suquamish Tribe, but neither extent of historic stream miles nor spawners were assigned.

APPENDIX B

PRESSURES ASSESSMENT – MIRADI OUTPUT

APPENDIX B: Pressure Assessment – Miradi Outpu

Threat Ratings – Summary Table

Pressures	Steelhead life stages					
	Egg incubation & emergence	Juvenile freshwater rearing	Smolts: early marine (Puget Sound)	Adults: return migration, holding, kelts	Adults: spawning	Maturation: open ocean
Timber harvest	High	High		Medium	Medium	
Roads and culverts	High	High	Medium	High	High	
Residential, commercial & industrial development	High	High	High	High	High	
Agriculture	High	High		Low	High	
Non-native fish*	High	High			High	
Invasive and non-native plant species*	Medium	High		Medium	Medium	
Water withdrawals	Medium	High		Low		
Climate change	High	High		Medium	Medium	
Flood control	Medium	Medium		Low	Low	
Mining	Medium	Medium	Low	Medium	Medium	
Dams	Low	Medium		Medium	Low	
Railroad - military	Low	Low	Low	Low	Low	
Military installations	Low	Low	Medium	Low	Low	
Harvest		Low		Low		Low
Hatcheries		Low	Low	Low	Low	
Commercial net pens^			Medium	Medium		

Pressures	Steelhead life stages					
	Egg incubation & emergence	Juvenile freshwater rearing	Smolts: early marine (Puget Sound)	Adults: return migration, holding, kelts	Adults: spawning	Maturation: open ocean
Commercial shellfish beds^			Low			

*These are combined as non-native species in the plan narrative | ^These are combined as commercial aquaculture in the plan narrative

Threat Rating Details

Egg incubation & emergence

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
Roads and Culverts	High	High	High	High	Logging roads are included in timber harvest. This pressure is all other roads. Considers not just culverts, but hydrology, sediment, stormwater, road location along creeks and shorelines, non-point source pollution, etc. Scope: see WDFW culvert map; the whole DIP is zoned for development so roads and culverts will be a continuing pressure in the future. No areas in this DIP that are naturally protected from roads like the upper reaches of other high elevation watersheds in west Hood Canal or eastern Puget Sound. Severity: high for all life stages; we included marine survival because of roads on nearshore areas that might impact forage fish. IR: There is immediate benefit from culvert replacement but constant threat of new roads. Old roads are harder to remove and abandon (two examples in DIP). Could be partially reversed but it would take many decades. If you fix passage you still have issues of the road itself - runoff, loss of cover, etc.
Timber harvest	Very High	High	High	High	Almost every part of the DIP was logged at one point. There are very few spots that were never logged or are currently late-successional forest. This results in legacy impacts as well as

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
					impacts related to current harvest (one of the last remaining stands of old growth was harvested just 3-4 years ago). Another concern is the lack of topographic or legal protections of existing forest (unlike higher elevation DIPs which have forested areas that won't be converted to housing due to elevation and topography, federal lands, etc). Scope: Current logging in Chico, Gorst, Anderson and elsewhere. Very high when consider legacy logging. Severity: Sediment, flashy flows, lack of shade, etc. considered more of a threat to eggs and juveniles than adults that can readily move. IR: Technically over time, this is reversible, but locally the timber owners are putting the land into 5acre parcels - conservation threat. It takes so long to regrow and get late-successional, but we don't want to write this off as an irreversible pressure.
Commercial net pens	Not Specified	Not Specified	Not Specified	Not Specified	
Hatcheries	Not Specified	Not Specified	Not Specified	Not Specified	
Flood control (dredging)	Medium	High	Medium	Medium	The regional definition includes major infrastructure short of dams: levees, channelization, etc. In East Kitsap the major issue is dredging and some small dikes. WDFW says they get a lot of permits for dredging and likely far more that is unpermitted. This includes the current act of dredging but also the legacy of past dredging. It increases flashy runoff and coupled with impervious surface results in scouring of redds. Emergency dredging is primary issue. When it is planned, they can permit in summer. The act of the dredging continues from legacy practices. Need outreach and education. Scope: There is more dredging on the smaller streams throughout the DIP, less of it in the major creeks.

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
					Severity varies by life stage - highest for incubation, less for adults who can move. IR: Medium because you could reverse it; need to focus on the culture of dredging or it will continue and expand.
Climate change	High	High	High	High	Climate impacts exacerbate hydrologic and sediment regimes - summer low flows, more frequent and higher magnitude flood events, higher temperatures and timing of temperatures. Scours redds, high temperatures can impede incubation and emergence. Assumption: where steelhead spawn later - the eggs and fry are more susceptible to temps and less to scour; those spawning earlier might be more susceptible to scour and less to temps. Warmer: Chico, Curley, some areas of Blackjack but there are also cold water refugia, Dogfish North flowing streams are protected by aspects. Systems with lakes are warmer and less resilient - more vulnerable to heating. Mid-century is when the big impacts hit, but we are already seeing impacts and they are cumulative.
Water withdrawals	Very High	Medium	High	Medium	High development pressure and the rural residential zoning allows easy permits for wells. Future PUD service could reduce the number wells, but that also requires more water rights for the utility. Starting to meter wells could open up new permits too. Entire DIP zoned as developable. Hydrology is dependent on surface and groundwater for flows - no snowpack or glaciers. Scope: Entire DIP Severity: Streams are currently running dry at a time when steelhead aren't incubating (into August), but if streams go dry earlier due to withdrawals and climate change, it would reduce incubation.IR: once wells are in and water rights are used it is hard to reverse, but ecologically feasible.
Non-native fish	High	High	Medium	High	It is an issue Chico, Curley, and probably some other systems with

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
					lakes and ponds -- important steelhead systems. Harder to deal with already stocked systems; similar to invasives where they always need to be managed. Competition and predation -- combined these are relevant to emergence and rearing. Less for adults.
Agriculture	High	High	Medium	High	This pressure includes previous conversion plus diking, draining, ditching and current non-point source pollution, lack of buffers, etc. In East Kitsap, these aren't the huge tracts with levees and big ag that we see in east Puget Sound, but still an impact especially to hydrology (channelized creeks, draining wetlands, creating ponds, etc) Scope higher if you include former ag (old fields). In some watersheds but not all. Chico = not much; Blackjack, Curley, Dogfish, Ollala = some. Formerly channelized. Incentive structures are currently for ag lands to become developed rather than restored. Where are there are still large tracts of land there are a lot more options. It is harder to get the wetlands restored, floodplain and channels will need to be reformed. Establishment is easy and reasonable cheap. This DIP doesn't have an ag production zone or other ag protection measures like the larger watersheds in PS. Scope: Group decided between medium and high. South end of DIP has a lot of ag, less in the central part of the DIP (Clear Ck has legacy ag upstream of highway crossing), and a lot of ag in north end of DIP. At least half of the important steelhead subwatersheds have ag. Severity: Major impacts to eggs and rearing and spawning (sediment, temps, etc). Adults can move so that life stage is less impacted; however, ag can greatly impact where adults can move, hold, and spawn (sediment) Irreversibility: possible to restore but takes time; hydrology is a big concern but easier to reverse/restore ag than developed areas. Largely small parcels that are easily converted to another pressure instead of restored.
Invasive and non-native plant	High	Medium	Medium	Medium	Invasive plant species are throughout old fields, disturbed riparian, etc. Need constant management, may increase with climate change.

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
species					Nightshade and other species have a direct impact on steelhead as a passage barrier, decomposing reed canary grass reduces DO, ivy destroys trees in riparian areas. Stressors that it acts through are summer stream temps (highest on juvenile), riparian functions like wood loading (similar for all or most FW life stages) Scope: High. Severity: If left unchecked this could increase to higher severity for certain life stages; IR: Medium: Can be managed and can restore with natives but will take more than 5 years and the scale is huge; requires consistent maintenance.
Railroad - military	Low	Medium	Medium	Low	Railroads are often combined with roads in regional definition (focus is culverts). For East Kitsap, the only railroad is owned by the military so this is pulled out to address with military installations - different management structure, regulations, etc. Scope: Medium because it crosses through many, but several key watersheds are not crossed by RR, including Dogfish, Blackjack, Curley, Steel, and others Severity: Impacts life stages all equally? No. Steve thinks probably affects adult migration most, then juvenile rearing, then eggs, etc. Reversibility: Medium...
Military installations	Low	Low	High	Low	Separate from industrial development because scope and management are so different. Extensive in this DIP. Legacy impacts and new stressors through noise, contaminants, haul outs and marine structures, stormwater, etc. DOD lands often follow different regulations than other development. Scope : Bremerton, Key Port, Manchester, passes through many watersheds; stormwater issues in Bangor overflow into Clear Ck (into EK DIP) Severity: Low for eggs and juveniles (often lower in watershed); high for juvenile mortality due to overwater structures/haulouts in

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
					nearshore. IR: high.
Mining (gravel)	Medium	Medium	High	Medium	The potential for mines is high. Get overlay from county. There are no buffer requirements, sediment issue, water quality, water extraction, etc. Many of the current mines are pretty far from streams but some are permitted right near tribs. The plantings that happen are erosion control, not habitat. Scope: Medium: The main concern is a mine on Dickerson Creek but they are pretty good about buffer in this case but possibility for future variances and exceptions of other sites. A few others exist but the threat of conversation from timber owners to mine is high across the DIP; current map may only be existing. Severity: Medium Irreversibility: Very hard to reverse the damage of mines once they are permitted - some revegetation and reclamation possible. Even with reclamation is it hard to return to functioning conditions.
Res, Comm, Industrial Development	Very High	High	High	High	Development threat is huge with push from east Puget Sound (high speed ferries, etc) This includes all impervious surface and associated stormwater, water treatment, utilities, etc. Curley is on fridge of UGA; Gorst is mix; Blackjack is almost all UGA; development is pervasive in Dyes, Liberty Bay and Carpenter Creek. Point and non-point pollution, lack of shade, high temps, flashy storms, etc. Nothing is undevelopable in DIP. Whole county is in 20 acres at best. Vashon may be different due to King Co regulations. May need to look at Comp Plan for details, but minor part of DIP. Scope: Future threat is huge in next 20 years. Basically entire DIP is developable/unprotected. Curley Ck is on fridge of UGA; Gorst is mix; Blackjack is almost all in UGA; Dyes, Liberty and Carpenter have pervasive development. The unknown is Vashon which may have different zoning. At best, Kitsap has 20 acre

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
					parcels. Severity: High where currently developed for all life stages; different issues for different life stages but all impacted severely by development Irreversibility: elements can be mitigated or restored but once a landscape is paved, it is hard to reverse.
Commercial shellfish beds	Not Specified	Not Specified	Not Specified	Not Specified	
Dams	Low	Low	Medium	Low	Low scope and severity-unlikely that these dams have major impact on sedimentation which would impact eggs and emergence. Primary issue is passage.

Juvenile rearing

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
Roads and Culverts	High	High	High	High	See egg incubation and emergence.
Timber harvest	Very High	High	High	High	See egg incubation and emergence.
Commercial net pens	Not Specified	Not Specified	Not Specified	Not Specified	
Hatcheries	Low	Medium	Medium	Low	Rainbow trout predation not considered here tackled in invasive/non-native species (out plants). There could be competitive interactions with coho, but the coho abundance isn't high enough for that to be a concern. Consider

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
					hatchery infrastructure and age of facilities in Grover's and Gorst: fish passage concerns, channelized, loss of complexity, scouring, (Gorst).
Flood control (dredging)	Medium	Medium	Medium	Medium	See egg incubation and emergence.
Climate change	High	Very High	High	High	See egg incubation and emergence.
Water withdrawals	Very High	High	High	High	See egg incubation and emergence. Severity: Biggest impact is to juveniles during summer rearing - a crucial period and life stage for this species.
Non-native fish	High	Very High	Medium	High	More readily reversed through ceasing the stocking of non-native fish -- see incubation. Hard to get rid of. Decided between very high and high -- because lack of evidence for steelhead, most work has been on coho and steelhead don't show up in gut contents because there are so few of them. Risk overwhelms the data because there are so few steelhead around. Definitely identified in Chico and Curley, and probably some other systems where we have lakes/ponds.
Agriculture	High	High	Medium	High	See egg incubation and emergence.
Harvest	Low	Medium	Medium	Low	Legacy harvest issues, but no current directed fishing. Poaching could be future issue as population increases. If very few steelhead exist then poaching would have a big impact. Only certain locations but they get hit hard. Incidental catch of steelhead through recreational freshwater fishing. This is more of a threat due how hard it is to determine the species. Scope: Low Severity: High where it exists for adults and juveniles (lakes)IR: Poaching is easily reversible through regulation and enforcement;

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
					incidental catch of juveniles is harder (medium?).
Invasive and non-native plant species	High	High	Medium	High	See incubation - temp, DO, potential for wood loss, etc.
Railroad - military	Low	High	Medium	Low	See incubation
Military installations	Low	Low	High	Low	See egg incubation and emergence.
Mining (gravel)	Medium	Medium	High	Medium	See egg incubation and emergence.
Res, Comm, Industrial Development	Very High	High	High	High	See egg incubation and emergence.
Dams	Medium	Medium	Medium	Medium	No large hydroelectric or storage dams. These are small dams that block passage but aren't major hydro or water storage systems. Consider weirs and other structures that form lakes as dams. Many are private. Only deemed an issue for adult migration and juveniles Scope: map in regional plan; WDFW passage map, small dams are known to exist in Blackjack, Gorst, Strawberry. Severity: some have ladders, some are publicly owned and managed; downstream passage often not an issue. IR: Once they are removed, they are gone, but other issues like sediment, upstream development, etc hamper full recovery

Maturation: open ocean

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
Harvest	Low	Low	Low	Low	Commercial bycatch. No evidence that this is particularly high; local plant won't likely address this life stage, but included it for full life cycle. Steve notes that we assume very low abundance so this might have a disproportionate impact.
Climate change	Not Specified	Not Specified	Not Specified	Not Specified	Not a pressure that we will address locally, but want to acknowledge it here. Marine foodweb impacts, competition, sea surface temperature anomolies, etc.

Smolts: early marine

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
Roads and Culverts	Medium	Medium	High	Medium	For early marine, this is focused on marine shoreline roads and the damage to forage fish/nearshore processes. North end of DIP looks good now but potential for development. Get input on forage fish impacts from SSMSP.
Non-native fish	Not Specified	Not Specified	Not Specified	Not Specified	
Timber harvest	Very High	Not Specified	High	Not Specified	
Railroad - military	Low	Medium	High	Low	
Agriculture	Not Specified	Not Specified	Not Specified	Not Specified	NOT A KNOWN ISSUE FOR SMOLTS - MOST AG IS IMPACTS FW LIFE STAGES
Commercial net pens	High	High	Low	Medium	Net pens attract pinnipeds (predators) on juveniles and Atlantic salmon as predators. When they harvest Atlantic salmon there is

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
					"bycatch" of juvenile native fish that are caught up in process. One large but on either side of Rich Passage - blocks migratory corridor. Severity is high. The stated plan is that net pens will be out by 2022, but not willing to assume this will happen.
Military installations	Medium	High	High	Medium	See egg incubation and emergence.
Hatcheries	Low	Low	Low	Low	See marine survival section of regional plan and determine whether other hatchery releases (Chinook, coho) could be part of testing to see if hatchery releases decrease (buffer prey hypotheses) or increase (attractant hypothesis) mortality of similar sized steelhead smolts.
Mining (gravel)	Low	Medium	High	Low	Military railroad only in Sinclair inlet - Gorst Creek. Forage fish issue.
Climate change	Not Specified	Not Specified	Not Specified	Not Specified	Marine food web changes - increased predators, lack of buffer prey.
Res, Comm, Industrial Development	High	High	High	High	With a 20 year projection of build out and residential. All piano keys. Currently less armoring in the north, decent eelgrass beds, but under threat from development. Evidence of stormwater/wastewater signal for smolt survival is largely from other watersheds (PBDEs), so mostly acts through forage fish loss and more predators from haul touts. But shoreline is likely to all be piano key development and a major threat to forage fish. Scope: North end is good now, but all shoreline is likely to be developed as piano key lots and a major threat to forage fish in next 20 years. Severity: overwater structures (haulouts); non-point and point-source pollution; impacts to forage fish: high for now - seek

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
					input from marine survival and TAG/WSWC.
Commercial shellfish beds	Low	Low	Low	Low	Defined geoduck farming as the main issue (tubes, nets impacting nearshore foraging, sediment, etc). Manila clams are broadcast seeded so likely have little impact. Some associated infrastructure may be an issue for forage fish, but it tends to be lower in intertidal and shouldn't impact beach spawning forage fish. Geoduck facilities may have more impact, but there isn't much overlap with eelgrass. Could be an issue for herring. Oyster farming is limited, some landowners doing small scale - Taylor Shellfish could expand in area later..

Adults: migration, holding, kelts

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
Roads and Culverts	High	High	High	High	See egg incubation and emergence.
Timber harvest	Very High	Medium	High	Medium	See egg incubation and emergence.
Commercial net pens	High	High	Low	Medium	Net pens attract predators on adults. Low rating for severity based on the disease implications of Atlantic salmon net pens for returning adults; predator attraction, etc. There is a plan for the Atlantic net pens to be out by 2022, but not wise to assume this will definitely happen.
Hatcheries	Low	Low	Low	Low	See juvenile rearing
Flood control	Medium	Low	Medium	Low	See egg incubation and emergence.

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
(dredging)					
Climate change	High	Medium	High	Medium	Not sure if we know enough to say that this is an issue. The fall and winter time is not impacted because no thermal barriers at that time of year. Adult migration/holding is in winter/spring, unless we're considering post-spawn kelts that remain in stream during summer Spawning is in winter/spring. I think severity is high, mainly due to potential redd scour
Water withdrawals	Very High	Low	High	Low	See egg incubation and emergence.
Non-native fish	Not Specified	Not Specified	Not Specified	Not Specified	Competition and predation are less of an issue for adults.
Harvest	Low	High	Low	Low	See juvenile rearing
Agriculture	High	Low	Low	Low	Lack of cover could result in more adult migrants being poached, vulnerable to predation, hitting thermal barriers? Adults migrating during cooler temperatures, but kelts might be deterred by thermal barriers but the females usually don't guard redds and might head out.
Invasive and non-native plant species	High	Medium	Medium	Medium	See incubation
Railroad - military	Low	High	Medium	Low	
Military installations	Medium	Low	High	Low	See egg incubation and emergence.
Mining (gravel)	Medium	Medium	High	Medium	See egg incubation and emergence.
Res, Comm,	Very	High	High	High	See egg incubation and emergence.

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
Industrial Development	High				
Dams	Medium	High	Medium	Medium	See juvenile rearing

Adults:spawning

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
Roads and Culverts	High	High	High	High	See egg incubation and emergence.
Timber harvest	Very High	Medium	High	Medium	See egg incubation and emergence.
Commercial net pens	Not Specified	Not Specified	Not Specified	Not Specified	Low rating for severity assumes that there are disease implications of Atlantic salmon net pens for returning adults; predator attraction, etc.
Hatcheries	Low	Low	Low	Low	There could be competitive interactions with hatchery coho, but the coho abundance isn't high enough for that to be a concern. Consider hatchery infrastructure and age of facilities in Grover's and Gorst: fish passage concerns, channelized, loss of complexity, scouring, (Gorst). In the 80s they used to replenish gravels near the hatchery. Rainbow trout predation not considered here tackled in invasive/non-native species (out plants).
Flood control (dredging)	Medium	Low	Medium	Low	The regional definition includes major infrastructure short of dams: levees, channelization, etc. In East Kitsap the major issue is dredging and some small dikes. WDFW says they get a lot of permits for dredging and likely far more that is unpermitted. This

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
					includes the current act of dredging but also the legacy of past dredging. It increases flashy runoff and coupled with impervious surface results in scouring of redds. Emergency dredging is primary issue (overlaps with spawning). When it is planned, they can do it in summer but there might still be redds or emerging fish. When it is planned, they can do it in summer. The act of the dredging continues from past the legacy issues. Scope: There is more on the smaller streams throughout the DIP, less of it in the major creeks. Severity varies by life stage - highest for incubation, less for adults who can move. IR: Medium because you could reverse it; need to focus on the culture of dredging or it will continue and expand.
Climate change	High	Medium	High	Medium	Impacts to spawning gravel are less known -- severity is medium. High irreversibility - we aren't purporting to reverse this but we will focus on adaption.
Non-native fish	High	High	Medium	High	This is likely a data gap; adult steelhead that would otherwise spawn with steelhead are having their eggs fertilized by stocked fish. IR: continuing impacts after stressor removed but easier to change and enforce policies to not plant rainbow; introgression would work itself out as well -- takes longer to work out introgression.
Agriculture	High	High	Medium	High	See egg incubation and emergence.
Invasive and non-native plant species	High	Medium	Medium	Medium	See incubation
Railroad - military	Low	High	Medium	Low	See incubation
Military installations	High	Low	High	Low	See egg incubation and emergence.

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Comments
Mining (gravel)	Medium	Medium	High	Medium	See egg incubation and emergence.
Res, Comm, Industrial Development	Very High	High	High	High	See egg incubation and emergence.
Dams	Medium	Low	Medium	Low	Addressed in adult migration - added spawning due to changes in sediment. Check severity with group. Changing sediment dynamics that impact spawning - change in sediment dynamics due to dams. Unclear how severe this is for spawning -- low or medium. Uncertain/ need more information.

<this is a cleaned-up export from a Miradi file is available on the Puget Sound Partnerships MiradiShare site under the steelhead program>

APPENDIX C

IMPLEMENTATION SCHEDULE / 10 YEAR START LIST

Appendix C:

IMPLEMENTATION SCHEDULE / 10-YEAR START LIST

Table of Contents

INTRODUCTION

The projects described by type in the following tables represent detailed actions with a clear location, outcome, and in some cases a project sponsor that have been identified and described previously in several relevant local plans and supporting documents. These projects are the actionable next steps to implement the sub-strategies described in Section 6 of the East Kitsap Steelhead Recovery Plan.

FISH PASSAGE

Blackjack Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
LBJ9	Fish Passage Improvements at Dogwood and Cedar road, SR 16, and Ferate Avenue	This action proposes removing full and partial fish passage barriers at Dogwood Road SE, SE Cedar Road, SR16, and Ferate Avenue SE/SE Rose Road.	This project will improve fish passage with a potential of adding 3,700 feet of fish habitat. This project will also reconnect habitats and improve the flow of sediment and nutrients, and the recruitment of large wood debris	Blackjack Watershed Assessment Plan, page 23	Wild Fish Conservancy (WFC) Project
LBJ10	Fish Passage Improvements at SR-16	This action would improve three, high priority culverts at SR 16.	This project will improve fish passage, reconnect isolated habitats, improve the flow of sediment, organic material, and nutrients.	Blackjack Watershed Assessment Plan, page 24 (photo)	WSDOT responsible per culvert case
MBJ5	Fish Passage Improvements at Sidney Road SW	This action would improve culverts at Sidney Road SW.	This project will improve fish passage, reconnect isolated habitats, improve the flow of sediment, organic material, and nutrients.	Blackjack Watershed Assessment Plan, page 30 (photo)	
UBJ3	Fish Passage Improvements west of Sidney Road	This action would investigate fish passage at a culvert west of Sidney Road and develop strategy to address findings.	This project will improve fish passage, reconnect isolated habitats, improve the flow of sediment, organic material, and nutrients.	Blackjack Watershed Assessment	

				Plan, page 36 (photo)	
RC4	Fish Passage Improvements at Ruby Creek	This action would replace the Ruby Creek culvert that crosses Sidney Road.	This project will improve fish passage, reconnect isolated habitats, improve the flow of sediment, organic material, and nutrients.	Blackjack Watershed Assessment Plan, page 40 (photo)	WFC Project
RC-5	Fish Passage Improvements Downstream of Glenwood Road	This action would replace the Ruby Creek culvert total barrier just south of Glenwood Road.	This project will improve fish passage, reconnect isolated habitats, improve the flow of sediment, organic material, and nutrients. Additionally, this action would prevent further channel incision and improve habitat through placement of in-channel LWD.	Blackjack Watershed Assessment Plan, page 41 (photo)	This action is modified from Aquascape II Project 72; also Kitsap Conservation District action with Silvernale Gingrey Property
RC-6	Fish Passage Improvements Downstream of Glenwood Road	This action would replace the Ruby Creek culvert partial barrier just south of Glenwood Road.	This project will improve fish passage, reconnect isolated habitats, improve the flow of sediment, organic material, and nutrients. Additionally, this action would prevent further channel incision and improve habitat through placement of in-channel LWD.	Blackjack Watershed Assessment Plan, page 42 (photo)	This action is modified from Aquascape II Project 72; also Kitsap Conservation District action with Silvernale Gingrey Property
RC-7	Fish Passage Improvements at Glenwood Road	This action would replace the Ruby Creek culvert partial barrier (due to velocity) at Glenwood Road.	This project will improve fish passage, reconnect isolated habitats, improve the flow of sediment, organic material, and nutrients.	Blackjack Watershed Assessment	This action is modified

				Plan, page 43 (photo)	from Aquascape II Project 74
RC-8	Fish Passage Improvements Upstream of Glenwood Rd and N Harper Rd	This action would replace three Ruby Creek culverts upstream of Glenwood Road and north of Harper Road.	This project will improve fish passage, reconnect isolated habitats, restore riparian vegetation, improve the flow of sediment, organic material, and nutrients.	Blackjack Watershed Assessment Plan, page 44 (photo)	Kitsap Conservation District action with Dow and Brown Properties
SC-3	Fish Passage Improvements and Habitat Restoration at SW Lake Flora Road	This action would develop a strategy to replace the Square Creek culvert barrier at SW Lake Flora Road	This project will improve fish passage, reconnect isolated habitats, improve the flow of sediment, organic material, and nutrients.	Blackjack Watershed Assessment Plan, page 50 (photo)	
SC-4	Fish Passage Improvements and Restoration at Glenwood Rd	This action would improve fish passage, remove a log weir, restore riparian habitat, and place large woody debris.	This project will improve fish passage, reconnect isolated habitats, improve the flow of sediment, organic material, and nutrients.	Blackjack Watershed Assessment Plan, page 50 (photo)	
SC-6	Fish Passage Improvements Upstream of Schweitzer	This action would replace a total culvert barrier of Square Creel.	This project will improve fish passage, reconnect isolated habitats, improve the flow of sediment, organic material, and nutrients.	Blackjack Watershed Assessment Plan, page 52 (photo)	Kitsap Conservation District action with Sweeney Property

Chico Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information

C2	SR 3 culvert replacement	The action is to restore fish passage by replacing the existing box culverts with a bridge.	Improve passage, natural channel migration and downstream transport of sediment and wood. No longer a barrier at low flow.	Chico Creek Watershed Assessment, page 108 (photo)	
C6	NW Golf Club Hill Rd culvert replacement	This action will replace the existing triple box culvert with a bridge crossing approximately 100 feet in width.	This approach will help address fish passage issues and aid in restoration of habitat-forming processes.	Chico Creek Watershed Assessment, page 112 (photo page 114)	
K3	Improve fish passage at stream crossing for private road new RS 2400	Replace the crossing with a wider culvert or bridge span, or remove road crossing from the floodplain.	Improve passage and connectivity.	Chico Creek Watershed Assessment, page 123 (photo)	
K5	Improve fish at the Northlake Way NW stream crossing	Replace the crossing with a bridge. Identified as complete barrier by WDFW, but coho seen upstream so considered partial barrier.	Improve passage by removing barrier and reduce confinement of stream	Chico Creek Watershed Assessment, page 124 (photo)	
K6	Remove infrastructure from outlet of Kitsap Lake	Remove infrastructure from the channel at the lake outlet to prevent future manipulation of lake levels.	Improve passage, reduce unauthorized change to lake levels by residents.	Chico Creek Watershed Assessment, page 125	
D4	Replace stream crossing at Navy railroad	Replace the crossing with a bridge or trestle to enable transport of sediment and wood downstream, and to improve fish passage by removing culverts that are velocity barriers.	Improve passage and wood and sediment transport.	Chico Creek Watershed Assessment, page 129	DOD?

W5	Culvert replacements for NW Wildcat Lake Road	Replace the passage barrier crossings with wider culverts or bridges.	Improve passage by replacing or removing culverts, building on a downstream passage project from 2011.	Chico Creek Watershed Assessment, page 135	

Curley Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
5	Banner Creek Crossing at Sedgwick Road	This action would replace the existing crossing with a bridge or larger culvert.	Improved passage	Curley Creek Watershed Assessment, page 105 (photo)	WSDOT
7	Unnamed Stream 15.0187 to Locker Road	Actions include a replacement of the concrete control with additional weirs or log assemblage and the removal of the dam and restoration of floodplain and channel migration zone at the tributary confluence.	Improve passage	Curley Creek Watershed Assessment, page 106 (photo)	
12	Salmonberry Creek crossing at SE Baker Rd	Actions would replace the existing culvert with a bridge or larger culvert.	Improved passage	Curley Creek Watershed Assessment, page 110 (photo)	County road?
17	Salmonberry Creek Crossing at SE Sedgwick Rd	Actions would replace the existing culvert with a bridge or larger culvert.	Improved fish passage.	Curley Creek Watershed Assessment, page 114 (photo)	WSDOT

21	Salmonberry Creek Crossing at Private Rd Downstream of Long Lake Rd	This action would replace the existing crossing with a bridge or larger culvert.	Improved fish passage.	Curley Creek Watershed Assessment, page 118	Private road – Kitsap CD or other?
22	Salmonberry Creek Crossing at Long Lk Rd	This action would replace the existing crossing with a bridge or larger culvert.	Improved fish passage.	Curley Creek Watershed Assessment, page 118	County road?
26	Upper Curley Creek	This action would replace the existing crossing with a bridge or larger culvert.	Improved passage – BUT CHECK TO SEE IF THIS IS ABOVE STEELHEAD EXTENT!	Curley Creek Watershed Assessment, page 124 (photo)	

Springbrook Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
5.3.1	Fletcher Bay Road NE Culvert and Weir Removal/Stream Restoration	This culvert is the lowest barrier in the creek system, and this project would replace the culvert, a failing weir complex, and bank armor.	This will improve fish passage, transport of sediment and woody debris, and remove the need for maintenance and repair.	Springbrook Creek Assessment Plan, page 87. (Photo)	

5.3.2	Eddy Culvert and Armor Removal, Bridge Replacement, Stream Restoration	This project is the second lowest barrier in the creek system, and would involve the replacement of an undersized culvert and armoring, as well as increase instream habitat complexity.	This project will improve fish passage, transport of sediment and woody debris, and widen the stream channel.	Springbrook Creek Assessment Plan, page 89. (Photo)	

FLOODPLAIN

Blackjack Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
LBJ6	Removal of Abandoned Foot Bridge	Remove abandoned foot bridge (Kendall Street bridge) crossing at RM 0.7 and develop options for utility relocation	This action would reconnect isolated habitats, restore connectivity, improve sediment and organic transport, and promote lateral migration.	Blackjack Watershed Assessment Plan, page 21. (Photo)	
LBJ8	Restoration on Mainstem between Sedgwick and SE Dogwood Road and Right Bank Tributary	Restore stream channel, riparian and associated wetland between Sedgwick and SE Dogwood Rd on the mainstem of Blackjack Creek. Also restore riparian and associated wetlands along right bank tributary present upstream of RM4.	This action would reconnect isolated habitats, restore connectivity, improve sediment and organic transport, and promote lateral migration.	Blackjack Watershed Assessment Plan, page 22. (Photo)	
LBJ11	Restoration at Confluence of Blackjack and Ruby Creeks	Re-meander channel, restore wetlands and riparian vegetation, and targeted LWD placement at confluence of Lower Blackjack Creek and Ruby Creek west of SR16 and east of Sidney Road SW.	Improves wetland floodplain storage, instream habitat conditions (specifically, groundwater recharge functions) of summer base flows, dissolved oxygen, and temperature.	Blackjack Watershed Assessment Plan, page 25.	

MBJ4	Restoration of Wetland and Floodplain between SE Lider Road and Sidney Road SW	Re-meander channelized reach, reconnect to floodplain, create off-channel habitat, install LWD, and conduct riparian restoration between SE Lider Road and Sidney Road SW (modified WFC Project M).	Improves wetland floodplain storage, lateral connectivity, instream habitat conditions (specifically, groundwater recharge functions) of summer base flows, dissolved oxygen, and temperature.	Blackjack Watershed Assessment Plan, page 29.	
MBJ7	Restoration on Mainstem west of Sidney Road SW	Restore wetlands and conduct riparian restoration and targeted LWD placement west of Sidney Road.	Improves wetland floodplain storage, lateral connectivity, instream habitat conditions (specifically, groundwater recharge functions) of summer base flows, dissolved oxygen, and temperature.	Blackjack Watershed Assessment Plan, page 31. (Photo)	
MBJ8	Restoration on Tributaries and Headwater Wetlands west of Sidney Road SW	Conduct riparian and wetland restoration and targeted LWD placement along tributaries and associated headwater wetlands west of Sidney Road.	Improves wetland floodplain storage, prevents further channel incision and improves habitat through placement of in-channel large woody material.	Blackjack Watershed Assessment Plan, page 32.	
RC3	Restoration of Ruby Creek Upstream of Wildlife Preserve	Construct naturalized channel, place LWD, and restore riparian vegetation east of Sidney Road and upstream of Ruby Creek Marsh Wildlife Preserve (WFC Project F).	Improves wetland floodplain storage, and improves instream habitat conditions (specifically, groundwater recharge functions) of summer base flows, dissolved oxygen, and temperature.		

RC9	Restoration of Ruby Creek north of SW Harper Road	Restore wetlands and re-meander channel, reconnect to floodplain, create off-channel habitat, and LWD placement along 2,000 feet of mainstem, north of SW Harper Road.	Restores lateral connectivity of riparian and floodplain areas, allowing lateral channel migration, promotion of side channel and off-channel habitat formation, floodplain connectivity, fine sediment storage, and decreasing stream energy during peak flow events.	Blackjack Watershed Assessment Plan, page 45.	
SC5	Restoration of Square Creek West of Glenwood Road	Re-meander channel, reconnect to floodplain, create off-channel habitat, riparian restoration, and targeted LWD placement in the 1,200-foot-long reach west of Glenwood Road SW.	Improves wetland floodplain storage, improves instream habitat conditions (specifically, groundwater recharge functions) of summer base flows, dissolved oxygen, and temperature, and restores lateral connectivity of riparian and floodplain areas, allowing lateral channel migration, promotion of side channel and off-channel habitat formation, floodplain connectivity, fine sediment storage, and decreasing stream energy during peak flow events.		
SL2	Protect Open Space	Ensure ongoing protection of open space areas surrounding north end of Square Lake, associated with McCormick Woods PUD.	Addresses riparian and floodplain processes by protecting headwater and floodplain wetlands, and protecting and restoring riparian functions.	Blackjack Watershed Assessment Plan, page 53.	

Chico Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
C3	Erlands Point Park Floodplain Restoration	This project will involve the removal of existing floodplain constraints (levee, metal debris rack), riparian forest restoration, and instream habitat enhancements.	This action will restore habitat-forming processes.	Chico Creek Watershed Assessment, page 108. (Photo)	
C5	Floodplain Restoration upstream of Erlands Point Road	Instream habitat conditions will be improved through strategic wood placements that will increase abundance of pool habitats, provide cover, increase channel complexity, and increase hydraulic roughness.	This action will remove artificial constraints to channel migration and reconnect floodplain areas.	Chico Creek Watershed Assessment, page 112.	
C7	Floodplain restoration upstream of NW Golf Club Hill Road	Conditions will be improved by removing artificial fill confining the stream corridor, strategic placement of large wood, creation of side-channel and off-channel habitats, and restoration of riparian forest conditions.	This action will restore floodplain connectivity and instream habitat conditions.	Chico Creek Watershed Assessment, page 114. (Photos).	
C9	Floodplain restoration between Chico Way NW and Northlake Way NW	Conditions will be improved with strategic wood placements designed to increase channel complexity and the restoration of natural stream grade control.	This action will restore instream habitat conditions and floodplain connectivity.	Chico Creek Watershed Assessment, page 116. (Photo)	
C11	Floodplain restoration between Northlake Way NW and NW Taylor Road.	Conditions will be improved through targeted wood placements to increase channel complexity and restore natural stream grade.	This action will aim to restore floodplain connectivity, riparian processes, and instream habitat conditions.	Chico Creek Watershed Assessment, page 118.	

C13	Floodplain restoration between NW Taylor Road and the Navy RR Trestle	Conditions will be improved by restoring riparian forest conditions and using targeted wood placements to increase channel complexity and restore natural stream grade.	This action will aim to restore floodplain connectivity, riparian processes, and instream habitat conditions.	Chico Creek Watershed Assessment, page 119.	
C15	Floodplain restoration upstream of Navy RR trestle	Conditions will be improved through the removal of artificial fill along the abandoned road grade constricting the channel, the restoration of riparian forest conditions, and targeted wood placements to increase channel complexity and restore natural stream grade.	This action will aim to restore floodplain connectivity, riparian processes, and instream habitat conditions.	Chico Creek Watershed Assessment, page 122.	
K2	Floodplain restoration along lower Kitsap Creek	This project will prevent further channel incision and increase channel complexity. Habitat forming processes are impaired in the lower reaches of Kitsap Creek by lack of floodplain connectivity due to channel incision, lack of large wood, and armored bank protection from residential development.	Conditions will be improved with wood placement, conservation easements, and/or the acquisition of property in the stream corridor.	Chico Creek Watershed Assessment, page 123.	
K7	Floodplain restoration upstream of Kitsap Lake	This project will restore a floodplain forest that has been cleared for development.		Chico Creek Watershed Assessment, page 126.	
K8	Floodplain restoration upstream of Reba Way	The floodplain through this reach is relatively intact; however, there are active mining activities that encroach into the stream corridor.	This work will protect the stream corridor from mining. All permits for mining activities would be reviewed for compliance with existing regulations.	Chico Creek Watershed Assessment, page 126.	

D1	Floodplain restoration from David Road to confluence with Chico Creek	Conditions will be improved with stable wood placements to force pools, provide cover and trap sediment to reconnect the channel with adjacent floodplain areas.	This project will improve habitat conditions in the lower reach of Dickerson Creek.	Chico Creek Watershed Assessment, page 127.	
D2	Floodplain restoration from David Road to failing log weirs	The floodplain upstream of David Road is relatively intact compared to the lower segment; however, the stream corridor is impaired from residential development set back only 60-80 feet from the channel and past clearing of the riparian forest.	Conditions will be improved with wood placements to increase channel complexity.	Chico Creek Watershed Assessment, page 127.	
D3	Floodplain restoration from log weirs to Navy RR culverts	Channel incision has resulted in an entrenched channel and disconnected adjacent floodplain areas.	Conditions will be improved with the restoration of wooded areas in this channel segment to increase channel complexity and help aggrade the bed to reconnect the floodplain.	Chico Creek Watershed Assessment, page 128. (Photos)	
W1	Floodplain Restoration through the homestead area of the Mountaineers Foundation Rhododendron Preserve.	The riparian forest has been cleared along the lower 500 ft of Wildcat Creek in an area now part of the Rhododendron Preserve. The channel is slightly incised, has unvegetated banks, and is lacking in channel complexity due to impairments to natural wood recruitment.	Conditions will be improved with the restoration of native forests, the removal of abandoned structures, addition of large wood to the stream, and minor excavation to restore side channels and wetlands.		

RIPARIAN

Blackjack Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
LBJ3	Protect Riparian Habitat – Blackjack Creek ravine	Acquire and protect high quality riparian habitat through acquisition and/or conservation easements; continue protection and development restrictions in lower Blackjack Creek ravine.	Addresses riparian and floodplain processes by protecting peak and base streamflow, sediment loading, in-stream wood, channel and floodplain complexity, water temperature, and food chain support.	Blackjack Creek Watershed Plan, page 19. Photo.	
LBJ5	Invasive Plant Removal	Invasive plant removal and riparian restoration in tidally-influenced portion of lower mainstem and upstream where invasive plants are present	Restores riparian processes of long-term wood recruitment, stream shading, bank and floodplain complexity, and food chain support.	Blackjack Creek Watershed Plan, page 21. Photo.	
MBJ3	Exclude livestock from the stream	Repair or install exclusion fencing to reduce unrestricted livestock access to stream and riparian habitats.	Prevents further streambank erosion, vegetation damage, and restores water quality.	Blackjack Creek Watershed Plan, page 29.	
MBJ6	Protect Riparian Habitat – Sidney Road SW	Acquire and protect high quality riparian habitat along Blackjack Creek just upstream of Sidney Road SW through acquisition and/or conservation easements.	Addresses riparian and floodplain processes by protecting peak and base streamflow, sediment loading, in-stream wood, channel and floodplain complexity, water temperature, and food chain support.	Blackjack Creek Watershed Plan, page 30.	Acquisition Plan
UBJ1	Protect Riparian Habitat – Mainstem Acquisition	Develop an acquisition and conservation plan to protect high quality habitat along mainstem.	Addresses riparian and floodplain processes by protecting peak and base streamflow, sediment loading, in-stream wood, channel and floodplain complexity, water temperature, and food chain support.	Blackjack Creek Watershed Plan, page 35.	Acquisition Plan

UBJ4	Protect Riparian Habitat – Upper watershed	Develop an acquisition and conservation plan to protect high quality habitat along tributaries in upper watershed.	Addresses riparian and floodplain processes by protecting peak and base streamflow, sediment loading, in-stream wood, channel and floodplain complexity, water temperature, and food chain support.	Blackjack Creek Watershed Plan, page 36.	Acquisition Plan
RC1	Protect Riparian Habitat – Ruby Creek upstream of Sidney Road	Develop an acquisition and conservation plan to protect high quality habitat on Ruby Creek upstream of Sidney Road.	Addresses riparian and floodplain processes by protecting peak and base streamflow, sediment loading, in-stream wood, channel and floodplain complexity, water temperature, and food chain support.	Blackjack Creek Watershed Plan, page 39.	Acquisition plan
RC10	Protect Riparian Habitat – McCormick Woods Road	Develop an acquisition and conservation plan to protect high quality habitat north of McCormick Woods Road and maintain current zoning designation in this area.	Addresses riparian and floodplain processes by protecting peak and base streamflow, sediment loading, in-stream wood, channel and floodplain complexity, water temperature, and food chain support.	Blackjack Creek Watershed Plan, page 45. (Photo)	Acquisition Plan
SC1	Protect Riparian Habitat – Square Creek upstream of Sidney Road	Develop a conservation plan to protect high quality habitat upstream of Sidney Road.	Addresses riparian and floodplain processes by protecting peak and base streamflow, sediment loading, in-stream wood, channel and floodplain complexity, water temperature, and food chain support.	Blackjack Creek Watershed Plan, page 49.	
SL1	Protect Riparian Habitat & Maintain Public Ownership	Maintain county ownership of land surrounding Square Lake, and protect existing forested and wetland conditions, including presence of beaver.	Addresses riparian and floodplain processes by protecting peak and base streamflow, sediment loading, in-stream wood, channel and floodplain complexity, water temperature, and food chain support.	Blackjack Creek Watershed Plan, page 53.	

Curley Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
2	Curley Creek Estuary to Sedgwick Road	Native riparian vegetation will be restored and replaced in locations where it was removed. Additionally, large woody debris will be placed in the stream to improve channel complexity	This project will improve natural wood recruitment to the stream and replace vegetation that has been removed.	Curley Creek Watershed Assessment, page 100. (Photo)	Mentions conservation easement.
9	Unnamed stream 15.0187 near Frog Pong Road	Riparian vegetation will be restored to promote future wood recruitment.	These actions will support instream habitat creation until the riparian habitat is able to naturally supply wood to the stream	Curley Creek Watershed Assessment, page 107	Acquire land for conservation.
13	Salmonberry Creek from Clover Valley Road to Baker Road	Riparian vegetation will be restored along with wood placement to create channel complexity.	This restoration will help the area recover from past clearing and aid with natural wood recruitment in the future.	Curley Creek Watershed Assessment, page 110.	
28	Long Lake Shoreline	This project will repair riparian habitat, and develop strategies to reduce the input of nutrients and pesticides into the lake.	These actions will result in a long term management plan for nutrient and pesticide inputs, and improve shoreline health.	Curley Creek Watershed Assessment, page 124.	

Springbrook Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
5.3.3	Rekow Stream and Riparian Restoration	This project will remove a derelict culvert from the stream channel, and remove invasive plants and plant native tree and shrub species	This project will improve stream flow and natural processes.	Springbrook Creek Watershed Assessment, page 90. (Photo)	
5.3.4	Nickum Stream and Riparian Restoration	This project will remove invasive reed canary grass and replant with native plant species to re-establish a riparian buffer.	This project will improve the quality of salmon rearing habitat, fish passage, water quality, and wood recruitment.	Springbrook Creek Watershed Assessment, page 91. (Photo)	

CHANNEL COMPLEXITY

Blackjack Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
LBJ4	Lower Blackjack Large Woody Debris Placement	This action would involve LWD placement until full riparian function is restored.	Prevents further channel incision and improves habitat through placement of in-channel large woody material.	Blackjack Creek Watershed Plan, page 20. (Photo)	
MBJ2	Middle Blackjack Large Woody Debris Placement	This action would involve LWD placement until full riparian function is restored.	Prevents further channel incision and improves habitat through placement of in-channel large woody material.	Blackjack Creek Watershed Plan, page 28. (Photo)	
SC2	Square Creek Large Woody Debris Placement	This action would involve LWD placement until full riparian function is restored.	Prevents further channel incision and improves habitat through placement of in-channel large woody material.	Blackjack Creek Watershed Plan, page 49. (Photo)	

Chico Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
K1	Instream habitat enhancement at the confluence with Chico Creek.	Conditions will be improved by installing wood placements to create additional complexity and efforts to setback floodplain constraints.	This would improve the tributary confluence with Chico Creek.	Chico Creek Watershed Assessment, page 122	
K4	Enhance instream habitat in the confined valley segment downstream of Kitsap lake	This action would involve the placement of large woody debris.	This action would increase channel complexity and limit channel incision.	Chico Creek Watershed Assessment, page 124	

Curley Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information (sponsor, cost, priority, etc)
1	Curly Creek Estuary and Nearshore	This project will identify shoreline armoring to be removed or replaced with soft shorelines, identify houses and structures to be moved away from shorelines, encourage compliance with the SMP, encourage the use of natural vegetation, and restore riparian habitats.	These projects will prevent future shoreline armoring, remove existing armoring, and restore natural shoreline processes in the face of rising sea levels.		

3	Curley Creek upstream of Sedgwick Road to Long Lake	The stream channel will be actively modified to move the stream out of the artificial ditch, and improve channel complexity. Restoration of riparian vegetation will complement this work.	This project will improve channel complexity and promote wood recruitment, helping to increase habitat. In addition to this work, beaver should be allowed to form dams and pools.	Curley Creek Watershed Assessment. (Photos)	Acquire land for conservation.
4	Banner Creek (15.0186) Crossing at Sedgwick Road	Large woody debris will be placed in the creek.	Large wood pieces will create steep-pool morphology to create habitat and dissipate stream energy to prevent channel incision.	Curley Creek Watershed Assessment.	Acquire land for conservation.
16	Salmonberry Creek from Cool Creek confluence to Sedgwick Road	Actions will aim to primarily re-meander the stream channel, in addition to riparian restoration and placement of large woody structures.	These actions will add channel complexity and move the stream out of the artificial ditch, and off-channel ponds and wetlands will be reconnected to the stream.	Curley Creek Watershed Assessment, page 111. (Photos)	Acquire land for conservation.
19	Salmonberry Creek from Salmonberry Road to Constructed Side Channel Ponds.	Previous restoration actions were completed in 2004, but roughly 1,000 feet of the stream has not been restored.	These actions will increase channel complexity by moving the stream out of the ditch, and restoring riparian habitat.	Curley Creek Watershed Assessment, page 115.	

20	Salmonberry Creek from Constructed Side Channel Ponds to Long Lake Road.	This project will move the creek out of the ditch that was constructed to drain agricultural lands.	These actions will improve channel complexity, floodplain connectivity, and riparian conditions.	Curley Creek Watershed Assessment, page 115. (Photos)	
24	Cool Creek Alluvial Fan Downstream of Phillips Road	This project will place large woody debris and move the channel out of a ditch. Additionally beaver will be encouraged to establish in this area.	These actions will improve channel complexity, and add more instream habitat and prevent stream incision.	Curley Creek Watershed Assessment, page 120. (Photos)	
25	Cool Creek upstream of Phillips Road	Wood will be placed in the stream within the Port Orchard UGA.	This action will increase channel complexity, and stabilize the channel from changes in flow due to past and ongoing residential development.	Curley Creek Watershed Assessment, page 120. (Photos)	
26	Cool Creek Downstream of Baker Road (Ashby Farm)	The landowner of this property has previously taken steps to restore riparian vegetation and exclude cattle, but this project proposes to restore the stream corridor with wood placements and additional riparian vegetation.	These actions will widen the stream corridor and create connections to side channel/off channel features.	Curley Creek Watershed Assessment, page 122. (Photo)	

LAND USE, ZONING, and ACQUISITIONS

Blackjack Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
LBJ7	Maintain or Expand Protective Zoning	Maintain or expand the current Greenbelt zoning and comprehensive plan land use designations below (north and east of) SR-16 (extending beyond current 200-foot shoreline	Protects watershed functions and upland, wetland, and riparian habitats through strengthened protections and better enforcement.	Blackjack Creek Watershed Plan, page 21. (Photo)	
LBJ12	Review and Improve Regulations and Requirements	Review and improve land use regulations and stormwater requirements for two residential areas near 1,000 foot-long tributary (east of Bethel Road) and near shorter tributaries (adjacent to Lippert Drive and SE Lund Avenue).	Strengthen regulations to protect watershed functions and upland, wetland, and riparian habitats from the potential impacts from ongoing development and redevelopment adjacent to tributary streams.	Blackjack Creek Watershed Plan, page 25.	
MBJ1	Review Existing Zoning	Review Port Orchard Land Use and Zoning designations in areas currently designated Commercial along SR-16 and above Blackjack Creek tributary.	Protects watershed functions and upland, wetland, and riparian habitats through strengthened protections.	Blackjack Creek Watershed Plan, page 28.	

UBJ2	Maintain or Expand Protective Zoning – mainstem	Maintain existing zoning (1 dwelling per 5 acres) to ensure protection of Upper Blackjack Creek, minimize potential for additional subdivision and impacts from development and redevelopment of existing rural parcels.	Protects watershed functions and upland, wetland, and riparian habitats through strengthened regulations.	Blackjack Creek Watershed Plan, page 35.	
UBJ5	Maintain or Expand Protective Zoning – tributaries	Maintain existing zoning (1 dwelling per 5 acres) to ensure protection of Upper Blackjack Creek, minimize potential for additional subdivision and impacts from development and redevelopment of existing rural parcels.	Protects watershed functions and upland, wetland, and riparian habitats through strengthened protections.	Blackjack Creek Watershed Plan, page 36.	
RC2	Review Existing Zoning	Review Port Orchard Land Use and Zoning Designations in areas currently designated Commercial and Residential High Density/R-20 along Ruby Creek above (west of) Blackjack Creek to determine if Land Use and Zoning changes should be proposed in the area.	Protects watershed functions and upland, wetland, and riparian habitats through strengthened protections and enforcement.	Blackjack Creek Watershed Plan, page 39.	*Is this directed at the City or would another entity do the initial review?*
RC11	Maintain or Expand Protective Zoning	Maintain existing zoning (1 dwelling per 8 acres; 1 dwelling per 12 acres) to ensure protection of upper Ruby Creek functions, continuing to limit potential impacts from development and redevelopment of rural parcels.	Protects watershed functions and upland, wetland, and riparian habitats through strengthened protections.	Blackjack Creek Watershed Plan, page 46.	*County?*

SC7	Maintain or Expand Protective Zoning – tributaries	Maintain existing zoning (Rural Residential: 1 dwelling per 5 acres) to ensure protection of southern tributaries, minimizing potential for additional subdivision and impacts from development and redevelopment of existing rural parcels.	Protects watershed functions and upland, wetland, and riparian habitats through strengthened protections.	Blackjack Creek Watershed Plan, page 52.	

Chico Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
W2	Protect corridor through privately owned parcels upstream of Mountaineers Foundation Rhododendron Preserve.	3,500 feet of the creek is under private ownership. This project will work to establish conservation easements in the corridor.	This action will protect the stream from future development and timber harvest that would impair habitat quality.	Chico Creek Watershed Assessment, page 134.	
W3	Protect corridor at confluence with tributary from Newberry Hill wetlands	500ft of the creek and 800ft of tributary channel is under private ownership. This project will work to establish conservation easements in the corridor.	This action will protect the stream from future development and timber harvest that would impair habitat quality.	Chico Creek Watershed Assessment, page 135.	

Curley Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
6	Banner Creek (15.1086) Upstream of Sedgwick Road	Land will be dedicated for habitat protection.	These part of the creek contains several tributaries near the headwaters, and protecting this land will prevent impacts from land use.	Curley Creek Watershed Assessment, page 105.	
8	Unnamed Stream 15.0187 in Ravine Upstream of Locker road	Land will be dedicated for habitat protection. Large woody debris will be placed to enhance stream habitat.	This is a steep stream that flows through a forested area, and the protection of this land will prevent channel incision and increased sediment loads.	Curley Creek Watershed Assessment, page 106	
10	Headwaters of unnamed stream 15.0187	Land will be dedicated for habitat protection. Large woody debris will be placed to enhance stream habitat.	This area is well forested and land conservation will protect this habitat in the future.	Curley Creek Watershed Assessment, page 107	
11	Salmonberry Creek Outlet at Long Lake	In order for restoration of riparian vegetation and floodplain protection to occur, land needs to be acquired through conservation easements.	Restoration will encourage wood recruitment and broaden the channel migration zone and improve floodplain health	Curley Creek Watershed Assessment, page 109. (Photos).	
15	Salmonberry Creek from Baker Road to Cool Creek confluence	This project will protect the stream corridor through conservation easements.	This action will preserve the wetland area at the confluence of cool creek.	Curley Creek Watershed Assessment, page 111.	

18	Salmonberry Creek between Sedgwick Road and Salmonberry Road	This project will protect the stream corridor through conservation easements.	This portion of the stream is well forested and this action will promote continued natural recruitment of large woody debris.	Curley Creek Watershed Assessment, page 115.	
27	Tributary Channels Draining Urban Growth Area	This project will map tributary channels to identify their location, and define a riparian corridor around the channels.	These actions will protect the tributary channels from future disturbance and support existing riparian vegetation.	Curley Creek Watershed Assessment, page 123. (Photo)	

Springbrook Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
5.3.5	Upper Springbrook Creek Protection	This project will protect 23 acres of undisturbed forested wetland, stream, and riparian habitat through land acquisition.	This action will preserve important habitat for fish, and for hydrologic processes throughout the watershed.	Springbook Creek Watershed Assessment, page 92. (Photo)	

MISCELLANEOUS

Blackjack Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
LBJ1	Tidal Delta Restoration	Develop a master plan for the Blackjack Creek tidal delta and adjacent nearshore that includes a comprehensive review of opportunities to restore tidal processes and estuarine habitat, land ownership and feasibility, and potential impacts from sea level rise.	Restoration of the tidal delta improves the lateral connectivity of the estuary, allowing for tidal exchange, the formation of distributary channels, and fluvial deposition.	Blackjack Creek Watershed Plan, page 18. (Photos)	
LBJ2	Viewing Platform	Appropriately sited viewing platform and/or interpretive area near pedestrian bridge or in the vicinity of estuary.	Promotes community education and awareness of historical habitat impacts, salmon, and salmonid habitat improvement and protection in the watershed.	Blackjack Creek Watershed Plan, page 19. (Photo)	
LBJ13	Stormwater Retrofits	Coordinate with City of Port Orchard Public Works to identify existing stormwater facilities that should be prioritized for retrofit of runoff detention and water quality functions.	Improve flood storage and attenuation processes by implementing low impact development activities such as new stormwater runoff facilities, facility retrofits, and flow control and water quality treatment for stormwater runoff.	Blackjack Creek Watershed Plan, page 25.	

Chico Creek Subwatershed

Action ID	Project Name	Description	Outcome	Reference	Additional information
C4	Erlands Point Road bridge replacement	The existing bridge confines the stream channel and restricts habitat-forming processes. Additionally, artificial fill used to construct the road embankment encroaches into the floodplain.	Habitat forming processes will be improved.	Chico Creek Watershed Assessment, page 110. (Photo)	WSDOT or County
C8	Chico Way NW bridge replacement and side channel reconnection	The new bridge will be modified to limit its restriction of habitat forming processes.	This action will open up the floodplain to reduce constriction and aid in the restoration of habitat-forming processes in upstream and downstream reaches.	Chico Creek Watershed Assessment, page 115. (Figure)	
C10	Northlake Way Bridge Replacement	This action will replace the bridge with a wider span to accommodate these future changes.	Restoration actions in other parts of the stream will result in a more dynamic channel and aggrade the channel overtime, making a new bridge necessary.	Chico Creek Watershed Assessment, page 118.	
C12	NW Taylor Road Bridge Replacement	This action will replace the bridge with a wider span to accommodate these future changes.	Restoration actions in other parts of the stream will result in a more dynamic channel and aggrade the	Chico Creek Watershed Assessment, page 118.	

			channel overtime, making a new bridge necessary.		
C14	Replace Navy RR trestle	The trestle's support piles are in the stream channel and constrain habitat forming processes.	A new trestle will accommodate channel migration and support a wider stream corridor.	Chico Creek Watershed Assessment, page 121.	
W4	Stream and wetland road crossings in Newberry Hill Heritage Park	Roads that cross the stream and wetland areas impair hydrologic processes. This project will work with stakeholder groups to implement the Newberry Hill Heritage Park Road Maintenance Plan, and evaluate infrastructure in the area.	This project will recommend actions to reduce hydrologic impacts and improve infrastructure.	Chico Creek Watershed Assessment, page 135.	

APPENDIX D

RESPONSE TO COMMENTS RECEIVED ON MARCH 2, 2020 REVIEW DRAFT

Name	Organization	Plan Section	Page Number	Comment	Response	Response Details
Brenda Padgham	Bainbridge Island Land Trust	Appendix C - Implementation Schedule / 10 Year Start List		Expand to include regulatory and enforcement actions. Explain how local jurisdictions are part of recovery, and link with the work of the LIO. Consider variances that have been granted and track changes in land use/permits over time.	Addressed	Added variance to monitoring metrics
Zack Holt	City of Port Orchard	Section 2 - East Kitsap Steelhead	17	Were any surveys or observations conducted on Annapolis or Karcher Creeks (I assume none as the streams aren't included)? Just curious if recovery goals could be considered for these streams as well.	Not Addressed	Consider for future monitoring and adaptive management
Zack Holt	City of Port Orchard	Section 4 - Recovery Pressures	34	I am curious about the Pressure/stressor graphic. In my experience, development impacts DO, as do roads. Water withdrawals also affect DO due to flow redux and standing pools.	Addressed	Change made to graphic
Greg Rabourn	King County	Section 2 - East Kitsap Steelhead		In addition to Judd and Christiansen Creeks on Vashon Island, Shinglemill, Fisher and Tahlequah Creeks are likely candidates. We have documented O.mykiss in Fisher and it is reasonable that some may be anadromous. Based on the length and cfs in Fisher, it is reasonable that the other streams would have or have the potential for O. mykiss as well.	Not Addressed	Change would result in too many cascading effects to other maps, graphics. Consider for future monitoring and adaptive management
Greg Rabourn	King County	Section 3 - Recovery Goals	28	From the Vashon- Maury Island Water Resources - A Retrospective of Contributions & Highlights report: The predominant land cover for the Island is forested land. Forested land covers about 73	Addressed	

Name	Organization	Plan Section	Page Number	Comment	Response	Response Details
				percent. Non-forest and developed land have percentages of 16 and 11 percent, respectively (KC, 2005c).		
Greg Rabourn	King County	Section 5 - Recovery Strategies and Sub-strategies	62	Re: Shore Friendly correction Local Organizations should educate waterfront homeowners on Shore Friendly…King County, King Conservation District, Mid Sound fisheries and WRIA 9 are partnering on Shore Friendly King County	Addressed	
Greg Rabourn	King County	Appendix C - Implementation Schedule / 10 Year Start List		Name: Maintain a Soft Armoring Technical Assistance and Cost-Share Program (AKA Shore Friendly); Description: This program would both offer technical assistance on alternative shoreline protection ("soft" armoring) and provide a cost-share program to encourage landowners to use these techniques; Outcome: Preventing/removing armoring and fill, Protecting/increasing vegetated shallow nearshore and marsh habitats , Protecting and restoring nearshore sediment transport processes, Protecting and expanding forage fish spawning areas.; Reference: 2005 WRIA 9 Salmon Habitat Plan Project N-2 Page 7-104 Green/Duwamish and Central Puget Sound Watershed Salmon Habitat Plan—August 2005	Addressed	
Greg Rabourn	King County	Appendix C - Implementation Schedule / 10 Year Start List		Name: Restore and Protect Nearshore Habitat on Vashon/Maury Island; Description: Protect and restore nearshore habitats in priority drift cells on Vashon-Maury Island. Priority areas include locations in the Maury Island Aquatic Reserve and the Pt Heyer Drift Cell. Efforts are		

Name	Organization	Plan Section	Page Number	Comment	Response	Response Details
				focused on removing armoring from feeder bluffs and maintaining and enhancing existing intact habitats.; Outcome: Protecting and improving riparian vegetation. Preventing/removing armoring and fill. Protecting/increasing vegetated shallow nearshore and marsh habitats. Protecting and restoring nearshore sediment transport processes. Protecting and expanding forage fish spawning areas.Protecting and enhancing pocket estuaries and tributary stream mouths; Reference:Project NS-17: Functioning Nearshore Habitat Protection on Vashon/Maury Island. Page 7-124 Green/Duwamish and Central Puget Sound Watershed Salmon Habitat Plan—August 2005		
Jamie Glasgow	Wild Fish Conservancy	Section 2 - East Kitsap Steelhead	13	What effort was made to survey steelhead distribution?	Addressed	Although eDNA is a tool to help identify presence of O.mykiss, a "negative" does not mean that they are absent in a stream. Following completion of this plan we should discuss how eDNA can help better understand steelhead use of our watersheds, limitations, etc.
Jamie Glasgow	Wild Fish Conservancy	Section 2 - East Kitsap Steelhead	13	What is the difference between steelhead-bearing stream miles and total current steelhead distribution?	Addressed	Clarified text. A better reference is Table 8 in App B showing miles of "historic" steelhead habitat in different

Name	Organization	Plan Section	Page Number	Comment	Response	Response Details
						watersheds. A more accurate statement is that nearly 50% of historic steelhead distrib is within the 3 drainages, Chico, Curley, and Blackjack.
Jamie Glasgow	Wild Fish Conservancy	Section 2 - East Kitsap Steelhead	16	Results are available in GIS and online - can we add a figure? wildfishconservancy.carto.com/viz/88884c9a-1868-46bc-8a6a-fc91ebffeb10/embed_map	Addressed	Added link rather than map
Jamie Glasgow	Wild Fish Conservancy	Section 3 - Recovery Goals	18	Elaborate on how tiers were defined. Important for transparency	Addressed	
Jamie Glasgow	Wild Fish Conservancy	Section 3 - Recovery Goals	28	Provide rationale for 65%. Why not higher?	Addressed	Added Booth et al. 2002 ref. This 65% can include scrub/shrub from NOAA C-CAP mapping. This is somewhat of a data gap and to better protect and restore watershed hydrologic conditions, we really should be looking at 65% "mature" forest, where "mature" is forest cover of at least 30 years old
Jamie Glasgow	Wild Fish Conservancy	Section 3 - Recovery Goals	30	Why not include 2030 or 2040 goal, as we did for accessibility?	Addressed	We only included 2030 goals for passage due to culvert case. Also, many habitat projects take decades to implement

Name	Organization	Plan Section	Page Number	Comment	Response	Response Details
						and to achieve complete or near complete ecological benefits.
Jamie Glasgow	Wild Fish Conservancy	Section 4 - Recovery Pressures	36	Does this assessment consider genetic impacts from stray hatchery steelhead? Doesn't really fit well with the life stage construct. With so few wild adult steelhead returning to the DIP, even limited genetic impacts can be significant. Do we have pHOS estimates? Introgression measurements? If not, how can we claim low threat? Does this assessment consider ecological impacts of within and out-of DIP hatchery programs (incl. chinook and coho) on our few wild steelhead? There appear to be at least 3 hatchery facilities in the DIP: https://slideplayer.com/slide/14137133/ Facility impacts (water diversion and altered flow, pollution, pathogens, barrier dams, delayed access, filling in floodplain, etc.) on steelhead habitat? The infrastructure at Gorst (Tier 1) is identified as a potential passage and sediment issue on a Tier 1 stream (p. 43). Similar opportunity at Grovers Cr.., also Tier 1. Ecological impacts (competition, predation) of off-station planting and new remote site incubation? Low impacts (summary) across the board is overly optimistic, esp. in the context of some of the threat ratings for other pressures	Noted	We consider introgression as potential threat - but from hatchery trout outplants (different pressure). Recent limited data suggests introgression may be an issue but more data is needed. We considered coho, chum, chinook hatchery production impacts on steelhead, and determined to be relatively little risk. Hatchery facility impacts on habitat should be assessed more closely considering Gorst and Grovers both built in lower floodplains, etc.

Name	Organization	Plan Section	Page Number	Comment	Response	Response Details
Jamie Glasgow	Wild Fish Conservancy	Section 4 - Recovery Pressures	36	How is the 'summary threat rating' calculated? Seems like two mediums and a low should summarize as a medium. How does a high, medium, and low get summarized as 'low' (mining, smolts)?	Addressed	Added link to Open Standards description rather than describing in the text
Jamie Glasgow	Wild Fish Conservancy	Section 4 - Recovery Pressures	38	We are ignoring dams associated with hatcheries	Addressed	Referenced the hatchery section which calls out passage issues and noted Gorst
Jamie Glasgow	Wild Fish Conservancy	Section 4 - Recovery Pressures	42	Agreed. What is the venue for this consideration?	Noted	A regional issue. Current information on stray rates from steelhead hatcheries outside of E Kitsap into E Kitsap streams is not well known and is a data gap.
Jamie Glasgow	Wild Fish Conservancy	Section 4 - Recovery Pressures	42	Potential genetic and ecological effects	Addressed	Yes, both ecological and genetic impacts
Jamie Glasgow	Wild Fish Conservancy	Section 4 - Recovery Pressures	43	Need clarification about: Directed fisheries for other salmonid species in the DIP and should consider impacts on steelhead	Addressed	Sentence clarified. We concluded that directed fisheries on coho, chinook, and chum in the DIP are unlikely to intercept steelhead, at least now. Harvest management plans, developed by co-managers and approved by NOAA Fisheries, have incidental take exemptions for ESA

Name	Organization	Plan Section	Page Number	Comment	Response	Response Details
						species, including steelhead.
Jamie Glasgow	Wild Fish Conservancy	Section 4 - Recovery Pressures	43	Not just if misidentified. Also due to C&R mortality (estimated at 10%)	Addressed	Yes, included risk of catch and release mortality
Jamie Glasgow	Wild Fish Conservancy	Section 4 - Recovery Pressures	45	Also fishing impacts on steelhead smolts, C&R mortality. Statewide Sthd Mgmt Plan commits to no rainbow plants in anadromous waters. See page 20, https://wdfw.wa.gov/sites/default/files/publications/00149/wdfw00149.pdf	Addressed	Yes, included
Jamie Glasgow	Wild Fish Conservancy	Section 4 - Recovery Pressures	45	Missing one of the largest concerns: the amplification of parasites (sea lice) and viruses (PRV, ISAv, etc.). Also water quality pollution assoc. with feed inefficiencies, fecal waste, medicated feed, etc.	Addressed	Added these potential threats
Jamie Glasgow	Wild Fish Conservancy	Section 5 - Recovery Strategies and Sub-strategies	50	Explore selective gears to reduce bycatch during other commercial fisheries. See F&W Commission Policy c3619. https://wdfw.wa.gov/sites/default/files/2019-07/02aug2019_12_summary.pdf also P. 13 of SSMP: Other Fisheries. Develop and promote the implementation of fishing methods and regulations that maximize the harvest of the target species while maintaining impacts to non-target species within allowable limits.	Noted	This may be regional scale issue and beyond our plan's scope. Even if we don't currently think incidental harvest is likely a problem it could become problem in future when abundance increases

Name	Organization	Plan Section	Page Number	Comment	Response	Response Details
Jamie Glasgow	Wild Fish Conservancy	Section 5 - Recovery Strategies and Sub-strategies	52	Perform systematic water type assessments to increase the effectiveness of HPAs and CAOs. Not just a forest practices issue	Addressed	
Jamie Glasgow	Wild Fish Conservancy	Section 5 - Recovery Strategies and Sub-strategies	63	Reduce predation in freshwater lakes is a harvest and hatchery pressure	Addressed	Yes to hatcheries. Harvest is addressed in next strategy
Jamie Glasgow	Wild Fish Conservancy	Section 5 - Recovery Strategies and Sub-strategies	65	Hatchery Scientific Review Group (for Hood Canal Coordination Group)	Not Addressed	Not clear that the HSRG is needed or appropriate here.
Jamie Glasgow	Wild Fish Conservancy	Section 6 - Implementing the Plan	68	Family Forest Fish Passage Program (add to funding sources)	Addressed	
Jamie Glasgow	Wild Fish Conservancy	Section 6 - Implementing the Plan	69	As written, does this goal allow us to lose existing forest in some watersheds? Should we set the goal at no loss, and those below 65% are brought to or above 65%? Is that 65% w/in the entire drainage area, or excluding the riparian area which has its own goal? If the latter, how is riparian defined?	Addressed	Clarified in table. Also, this 65% upland forest cover can include scrub/shrub from NOAA C-CAP mapping. This is somewhat of a data gap and to better protect and restore watershed hydrologic conditions, we really should be looking at 65% "mature" forest, where "mature" is forest cover of at least 30 years old.
Jamie Glasgow	Wild Fish Conservancy	Section 7 - Monitoring Framework	71	We should commit to coordinate monitoring efforts with WDFW's PS	Noted	For future AM/implementation. We included language about

Name	Organization	Plan Section	Page Number	Comment	Response	Response Details
				Steelhead Monitoring Program headed by Joe Anderson		EKDIP being a regional priority for monitoring
Jamie Glasgow	Wild Fish Conservancy	Section 7 - Monitoring Framework	72	A population genetics study to determine relatedness among watersheds, hatchery introgression, and effective population sizes. Tissue sampling of juvenile mykiss, coordinated with Ken Warheit	Addressed	Added to end of 1st para on p 72
Jamie Glasgow	Wild Fish Conservancy	Section 7 - Monitoring Framework	73	Several comments regarding monitoring and metrics/indicators	Noted	Yes, some of these could be included in later development of full monitoring plan
Jamie Glasgow	Wild Fish Conservancy	Section 7 - Monitoring Framework	74	Cease planting hatchery rainbow trout in anadromous waters of the state, as per SSMP	Addressed	Yes, this is sub-strategy. Need to consider what the indicator s/b - reduction of warmwater fish and cease planting of hatchery rainbow?
Jamie Glasgow	Wild Fish Conservancy	Section 8 - Data Gaps and Information Needs	75	This (current use and abundance) exists regardless of the lack of information	Addressed	
Jamie Glasgow	Wild Fish Conservancy	Section 8 - Data Gaps and Information Needs	75	What about ocean productivity, marine mammal predation, disease, etc. Maybe qualify with '...likely limiting freshwater factors...'	Addressed	
Jamie Glasgow	Wild Fish Conservancy	Section 8 - Data Gaps and Information Needs	75	Also see WDFW's Steelhead at Risk Report (2018). Deficient is an understatement. https://wdfw.wa.gov/publications/02070	Noted	
Jamie Glasgow	Wild Fish Conservancy	Section 8 - Data Gaps and	76	Replace "Analyze tags recovered from other areas..." wtih "Analyze	Addressed	

Name	Organization	Plan Section	Page Number	Comment	Response	Response Details
		Information Needs		CWTs and catch data from all fisheries to understand the..."		
Jamie Glasgow	Wild Fish Conservancy	Section 8 - Data Gaps and Information Needs	77	Add net pen aquaculture industry	Addressed	
Nick Gayeski	Wild Fish Conservancy	Section 3 - Recovery Goals		Several comments	Noted	See separate document following this summary matrix with expanded response to comment
Kirvie Mesebelu u-Yobech	WSPER	Section 1 - Introduction and Background	6	Salmon and steelhead recovery is part of the broader ecosystem restoration effort in the Puget Sound region, as led by the Puget Sound Partnership's Action Agenda (2018). The Action Agenda defines nine Local Integrating Organizations (LIOs) that coordinate local actions; the East Kitsap DIP is part of the West Central Sound Partners for Ecosystem Recovery (WSPER) LIO, which coordinates actions on the east side of the Kitsap Peninsula and consists of the following cities, counties, and tribes: • Suquamish Tribe • Kitsap County • City of Bainbridge Island • City of Bremerton • City of Gig Harbor	Addressed	

Name	Organization	Plan Section	Page Number	Comment	Response	Response Details
				• Pierce County • Port Gamble S'Klallam Tribe • City of Port Orchard • City of Poulsbo The West Central LIO, known as the West Sound Partners for Ecosystem Recovery (WSPER), consists of an Executive Committee and and three a working groups that focus on shellfish, stormwater, and salmon habitat. The WSPER also includes a technical advisory group that focus on technical review of salmon recovery projects within the lead entity process. The salmon habitat subgroup technical advisory group focus on for most of the East Kitsap DIP is eastern Water Resource Inventory Area (WRIA) 15 the WSWC, the area's Lead Entity for salmon recovery as described above. In addition, the Water Resource Inventory Area 9 (WRIA 9) Watershed Ecosystem Forum is the Lead Entity for a single subwatershed, Vashon Island, which is in King County and managed as part of WRIA 9 for Chinook salmon recovery. To develop this plan, the		

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				Suquamish Tribe used contractor support from Environmental Science Associates to gather and analyze information on steelhead population and habitat, develop goals, analyze pressures, and assist with the development of strategies and actions related to steelhead, as well as to convene stakeholders to review and discuss the information. Over the course of the project, the Tribe engaged stakeholders – both the WSPER/WSWC Lead Entity working group and the salmon technical advisory group and the West Central LIO – in several workshops and meetings and provided draft materials for review.		
Kirvie Mesebeluu-Yobech	WSPER	Section 3 - Recovery Goals	26	The team assessed existing information and developed draft goal statements for review and revision by salmon recovery partners. The West Sound Watersheds Council (WSWC) West Sound Partners for Ecosystem Recovery (WSPER) salmon technical advisory group (TAG) assisted helped identify the highest priority habitat types and available information to support goal setting, and vetted the goal	Addressed	

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				language over a series of meetings.		
Kirvie Mesebeluu-Yobech	WSPER	Section 4 - Recovery Pressures	33	The pressures assessment for the East Kitsap Steelhead DIP was conducted by gathering available information about relevant regional pressures from existing plans, vetting the list with the Suquamish Tribe, and reviewing and rating the pressures with the Lead Entity (WSWC WSPER) Salmon Technical Advisory Group and other stakeholders through a series of meetings.	Addressed	
Brenda Padgham	Bainbridge Island Land Trust	Appendix C - Implementation Schedule / 10 Year Start List		Separate the zoning and land use actions from those that are focused on acquisitions	Addressed	
Brittany Gordon	WDFW	Appendix C - Implementation Schedule / 10 Year Start List		Review beaver re-introduction plans from other areas	Noted	Not actionable now, but consider for future AM/implementation
		Section 6 - Implementing the Plan		Many of the actions are focused on tier 1 streams, how does the plan address actions on tier 2 and 3 streams?	Addressed	New language added: Lower tiers are considered when consistent with the strategies and where there is a demonstrated need. Just one angle of prioritization - projects will be considered individually and weighed against the

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						benefit of others through grant round and other processes.
Kathy Peters	Kitsap County	Section 7 - Monitoring Framework		Comment from workshop to use the PSEMP work for the riparian indicator	Addressed	Added a comment to the bottom of the table about using the PSEMP metric once it is finalized.

Comments on the East Kitsap Steelhead Recovery Plan

Nick Gayeski, Wild Fish Conservancy

March 20, 2020

The following are very brief comments on the population goals in the Recovery Plan (RP) (Section 3.2, pp. 23-25). I focus on the model used to help identify the recovery goals for the "Local Plan", Table 3-2, p.23.

Spawner-Recruit Modeling.

The Local Plan and the associated Beverton-Holt spawner-recruit model assume an unfished equilibrium population abundance (EQ) of 3000 for a recovered aggregate population. An EQ of 3000 does not seem unreasonable and I have no comments concerning this assumption.

I do have a concern with the estimated value of the productivity parameter, alpha, derived from the Beverton-Holt model. As noted on page 24 of the RP, this is based on Buehrens' estimate of an intrinsic productivity of 110 smolts-per-spawner, which translates to an estimated value of the alpha parameter of 6.6 which strikes me as very high for such a diverse aggregate of depressed small populations. And although there are good biological reasons to expect that a steelhead population will exhibit Beverton-Holt- (or Hockey Stick-) like spawner-recruit dynamics, there are many cases in which steelhead population spawner-recruit time series fit a Ricker model better than a Beverton-Holt (the Skagit River steelhead population is one case). These cases may indicate pathologies in the spawner-recruit (SR) dynamics that are important to take into account in recovery planning.

Response: Whereas we understand and appreciate this concern, we do not intend to revisit Buehrens' (2017) analysis or his use of a hockey stick model to derive fundamental biological reference points at this time. As stated in the EK DIP recovery plan, the population goals (and underlying assumptions concerning productivity and capacity) are a rough estimation of what a healthy population would exhibit locally and based on best available information. As more and better information about local habitat and steelhead population conditions is developed, we expect a more informed picture of what a healthy population looks like will come into focus. These population goals can be modified at that time.

Another concern with the Beverton-Holt model is that it has a strong tendency to over-estimate the alpha parameter, especially when data are scarce in general or when there are few or no data points at very low spawner abundance levels in the time series. The Ricker spawner-recruit model obtains some information about the magnitude of alpha from the descending limb of the SR curve, which occurs at spawner abundance levels to the right of the point of maximum recruitment, in addition to points of low spawner abundance levels which occur at the far left of the curve. So, it is worth considering a Ricker model for the same estimate of the unfished equilibrium abundance level adopted for the Local Plan (3000).

Response: A Ricker function to model/depict the spawner-recruit relationship could have been included in the plan as part of the section on population goals. However, we chose the B-H model because we could parameterize the function using data from Buehrens (2017), which covers a range of systems including some that are very similar to those found in East Kitsap.

I calculated spawners and recruits for both the Beverton-Holt model as parameterized in the RP and shown in RP figure 3-4, page 25, and the Ricker model with alpha set equal to a modest productivity value of 3.0 and EQ = 3000. Figure 1 shows the curves for both models together with the 1-to-1 replacement line. This is essentially RP figure 3-4 with the Ricker curve added.

Response: For the purposes of this plan, these 2 curves are very similar and well within a range of reasonable uncertainty.

For the Beverton-Holt model, as noted in part in the RP, Smsy (the spawner abundance level that on average yields the maximum yield) is 841 which is 28% of EQ. The average recruitment at Smsy is 2160, and Hmsy (the average harvest at Smsy) is 1317, which yields a harvest rate of 61%! For the Ricker model, Smsy is 1278 spawners, which produces an average total recruitment (Rmsy) of 2401, yielding an average harvest (Hmsy) of 1123, and an average harvest rate (HRmsy) of 47%. This, of course, is not to imply that a recovered population should be harvested at an estimated maximum sustainable yield harvest rate or that spawner escapement should be managed at the estimated Smsy abundance. It is simply to provide a relevant comparison of the expected average population dynamics if the true population dynamics were correctly characterized by one or the other model.

Response: we have used conventional notation to describe the B-H model consistent with the regional recovery plan. Use of terms such as "maximum sustained yield" should not imply that the population goals are intended to evaluate or guide current or future harvest management. We do not see that as a reality in the foreseeable future.

I also question the annotation of the Smsy and EQ points on the X axis of figure 3-2. Population productivity is best characterized and interpreted by the spawner-recruit curve itself, not by a single point-estimate of "maximum productivity". The alpha parameter characterizes the entire spawner-recruit process, although it also entirely determines the relative value of the point-estimate of Smsy (its proportion of the unfished equilibrium abundance EQ). Smsy is indeed the single average spawning escapement that produces the largest total recruitment in relation to the level of spawner abundance, and in this limited sense only can it be said to characterize the "productivity" of the population. It is, therefore, inaccurate to characterize the spawner escapement at the equilibrium abundance as "low productivity". In fact, under a recovery planning scenario, there is good reason to manage the population to achieve EQ (and to continuously identify what the current level of EQ may be). And, there is also a good case to be made for considering EQ in relation to total spawning or rearing habitat area to be a more appropriate characterization of population productivity than the point estimate of Smsy. Filling all available spawning and rearing habitats to the greatest extent possible on an annual basis is a considerably more appropriate, precautionary, and responsible management target for a recovering (or recently recovered) population than Smsy. And if a Ricker model is the more appropriate model of population dynamics than a Beverton-Holt of the same EQ, Smax (= beta) provides a more precautionary reference point for managing spawning escapement of a recovered population than Smsy.

Response: We agree that the alpha parameter characterizes the entire spawner recruit process. The curve of the B-H function (or Ricker if you prefer) reflects the influence of both the alpha parameter (intrinsic productivity or density independence) and the increasing effect of density dependence at higher spawner abundances.

I also raise a concern with the parameterization of the Beverton-Holt model used in the RP. There are (at least) two equally accurate parameterizations of the model:

A. R = alpha*S/[1+ (alpha/beta)*S] = alpha*S/[1+(alpha*S)/beta]; and,
B. R = alpha*S/(1+S/beta).

Although both equations produce identical recruitment for any level of spawner abundance and hence identical curves, the meaning of the beta parameter in each is importantly different. In variant-A, which is the one used in the RP, beta is an estimate of the maximum possible recruitment. In nearly all cases, beta in this (variant-A) parameterization is biologically meaningless and consequently is of no value in guiding management. For the parameterization given in the RP and listed in the title of figure 1 below, beta has a value of 3536 but this value occurs at a spawner abundance of over 805 billion spawners! Recruitment at 15000 spawners is 3414.

In variant-B, beta is the estimate of the spawner abundance at which average total recruitment is one-half of the maximum, which in this case occurs at a spawner abundance of 536 spawners (producing an average recruitment of 1768, which is one-half of the variant-A value of beta of 3536, as it should be). This feature of beta provides a more reasonable index of density-dependence than variant-A, and at least has some plausible relevance of management, though EQ is still a considerably more informative and relevant precautionary reference point.

Response: In our construction of the B-H function, beta is an asymptote, essentially the carrying capacity for the population. The model is intended to depict the response of the population to density dependent and density independent processes over a narrow range of spawner abundance. We agree that the model is meaningless at very high spawner numbers.

Other management reference points of relevance.

Given the absence of robust spawner and recruit time series of the populations and population aggregate at issue, which causes significant uncertainty about management-relevant spawner-recruit models and model parameters, it appears important to consider and employ other metrics that may be more measureable and that would better guide stock monitoring. In particular, interim targets for parr and smolt production (which ultimately translate into stock recruitment alpha parameters as shown by the average smolt-per-spawner value identified by Buehrens for the populations in his study (110 smolts/spawner).

Given the small size of the watersheds that are the subject of the RP it should be possible to monitor annual parr and smolt production and estimate the current carrying capacity of each tributary. It would be particularly important to estimate the numbers of parr- and smolt-per-square meter of rearing habitat and the number of eggs-per-square meter of spawning habitat required to achieve maximum parr and smolt production. This is the approach adopted a decade ago by Norway to management the both depressed and healthy wild Atlantic salmon populations (Forseth et al. 2013, Gayeski et al. 2018). One or both of these tributary habitat-based metrics should be an aim of recovery planning.

Response: As we have stated here and in the plan, we agree there is significant uncertainty concerning the model. With the information available, no model would be sufficient for "management" relevance. The model here is simply to propose goals (albeit imperfect) for the population. We agree with your comment concerning the need for better monitoring of the population. We also agree that the focus of our plan should be on improving conditions that we have some control over, namely local habitat conditions. This is what this recovery plan for East Kitsap tributaries is all about.

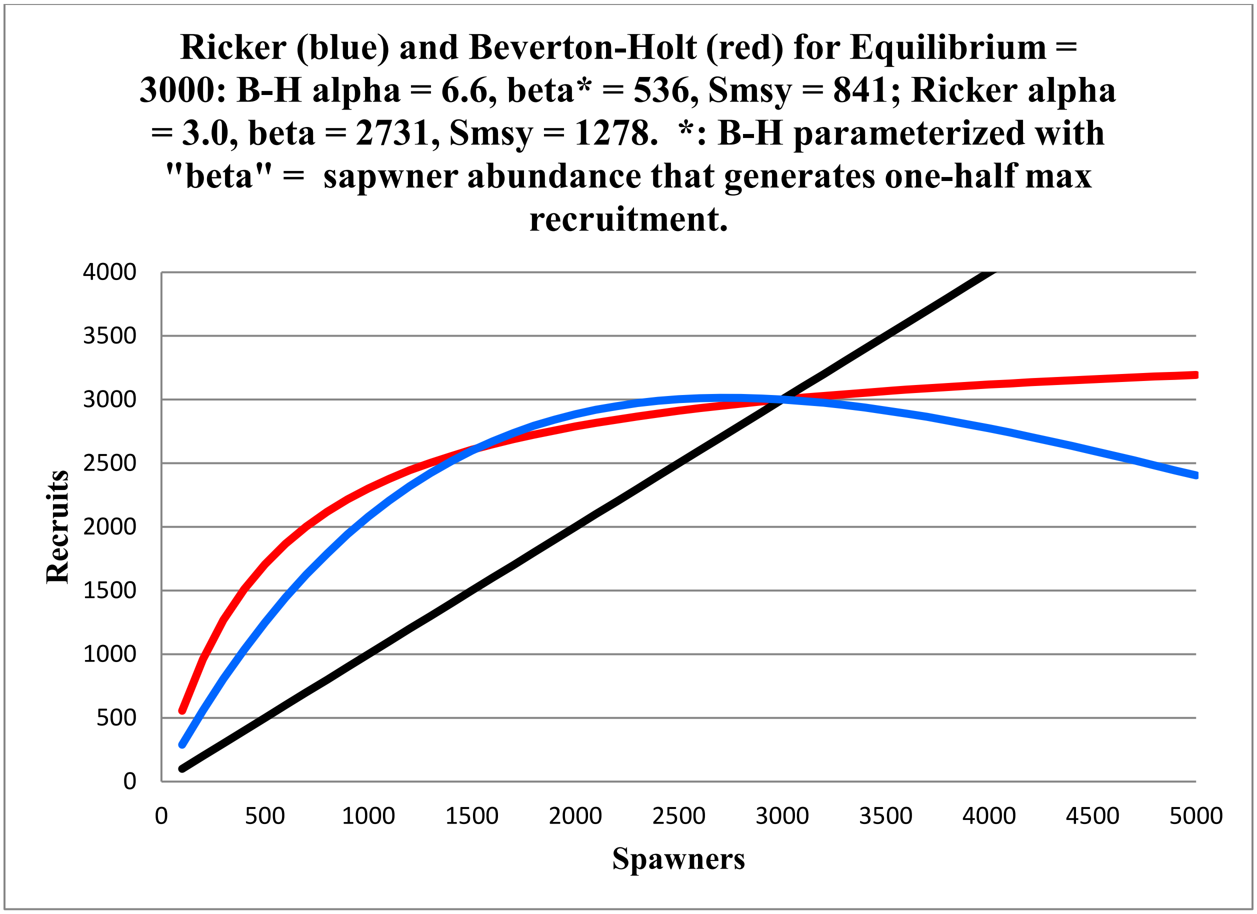

Figure 1. Beverton-Holt and Ricker models of the aggregate East Kitsap steelhead populations.

<u>References.</u>

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